ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

Further and further into the metallurgical field edge electrical methods. On merit alone the heat-treating realm, so far as special alloys and high-quality materials are concerned, has yielded to electricity. Welding has transformed the whole field of machine design and assembly. At the National Metals Congress in Detroit last week the story of continued progress was told. No spectacular new developments such as the centrifugal electric furnace of some months ago, but refinements in other practices. Steel men are not overlooking any bets these days.

●

President H. Lester Hooker of the National Association of Railroad and Utilities Commissioners, also chairman of the Corporation Commission of Virginia, made a strong plea for more intelligent regulation at the closing session of the American Gas Association convention. It is refreshing to hear pleas on that basis instead of for merely radical action This week the utilities commissioners held their convention in Cincinnati. Portentous news may develop. Regulation, however one may look at it, has been going through a revolution.

●

Consider the uncertainties of being a high commissioner. The political mortality is high. One year ago, upon the completion of the term of office of J. J. Murphy, of South Dakota, as president of the N. A. R. U. C., Hugh Williams, of New Mexico, succeeded him. Failing to be re-elected as a commissioner he resigned the presidency to be succeeded by Paul Kuhn, of Illinois, who was not reappointed to his commission by the governor and therefore resigned the presidency. Amos Betts, Arizona, succeeded him but resigned from the Arizona board and yielded the guidance of the N. A. R. U. C. to Commissioner Hooker, who presided at the convention this week. Four presidents in one year. Add to the list of uncertain occupations.

●

Editors have reason to ponder upon the uses of publicity at frequent intervals. Self-originating news is so invariably constructive in a highly exclusive manner that it is often the job to learn the other side, if any. T. V. A. exudes vast quantities of material about the valley, pushing hard to keep the project before the public eye.

L. W. W. MORROW, Editor

A. M. PERRY, Managing Editor
A. E. KNOWLTON, Associate Editor
E. R. SEARLES, News Editor
G. F. WITTIG, Statistical Editor
EARL WHITEHORNE, Contributing Editor
FRANK R. INNES, Western Editor, 520 N. Michigan Ave., Chicago
C. W. LEIHY, Pacific Coast Editor, 883 Mission St., San Francisco
H. S. KNOWLTON, Contributing Editor, 1427 Statler Bldg., Boston
PAUL WOOTON, Washington Correspondent, National Press Building, Washington

JAMES H. RUDD, Publishing Director

OCTOBER 14, 1933

Contents Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.

VOLUME 102 . . . NUMBER 16

Political Hygiene and Public Ownership 492
By ARTHUR E. MORGAN, Tennessee Valley Authority

To Select Commercial Lighting Fixtures 494
By KARL STALEY, General Electric Company

Modernization in Tractor Manufacture... 497

Trends in Turbine Engineering..... 501
By C. RICHARD SODERBERG, Westinghouse Electric & Manufacturing Company

What Lies Ahead?..... 503
By C. J. GOODNOUGH, Pennsylvania Public Service Commission

Grid Control of Mercury-Arc Rectifier.. 507
By OTHMAR K. MARTI, Allis-Chalmers Manufacturing Company

Need Revision of Power Sales Organizations. 493
Need Specific Approach to Market..... 498
Foundrymen Indict Industrial Rates..... 499
Indirect Portable Increases Home Revenue... 500
Power System Grounding Rod..... 502
Starting M-G Substation After Plant Shutdown..... 505
Practices Instituted for Economy..... 506
Vacant Stores Yield Revenue..... 509
Electricity Not Dangerous..... 510
Readers' Forum..... 510
Men of the Industry..... 511
New Equipment Available..... 512

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

ELECTRICAL WORLD—Published weekly, price 25 cents a copy. Subscription rates—United States, Mexico and Central and South American countries $5 a year. Canada, including duty, $7.50 a year. All other countries $9, or 45 shillings, a year. Entered as second-class matter January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable address: MCGRAWHILL, New York. Member A.B.P. Member A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 W. 42d St., New York, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

Printed by The Schweinler Press, N. Y.

NRA MEMBER U.S. WE DO OUR PART

A KILOWATT A CALL

with the New Approach to Selling Lighting

We quote from a letter from a large eastern lighting company. It is typical of many in our files:

"While we have just had the kit for a few days—7 kilowatts will be added to our load as a result of 7 calls. In each case it was greeted with favorable comment, and on every call we were able to secure added load, or install a trial demonstration."

Another company says:

"After purchasing four kits and instructing salesmen in their use, a man was sent out to make calls. In the period of the first three weeks, the results appear in part as follows:

Number of calls	216
Immediate installations resulting	11
Kilowatts	8½
KW Hours	12,640 (estimated)
Revenue	$374
Prospects—	
Show windows	26
Store interiors	42
Store exteriors	3
Estimated revenue from above prospects—	
Show windows	$1,235
Store interiors	3,620
Store exteriors	175
Re-painting jobs stimulated	21
Mazda lamp sales stimulated	$1,000 (estimated)
Equipment sales stimulated	409
Complaints satisfied	24

"The customers are almost always appreciative of the service rendered and every one of the 24 complaints has been easily and satisfactorily settled. In fact one seemingly bad complaint was turned into a brand new window lighting installation. In many cases the merchant will interrupt the story to bring in neighboring merchants. Customers too show great interest."

* * * *

The New Approach to Selling Lighting is a proven way to add lighting load. It is at work now, building revenue for many utilities. Why not put it to work for you? A letter to the sales division which supplies you with lamps will bring you complete information. General Electric Company, Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC

MAZDA LAMPS

ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

October 14, 1933

L. W. W. MORROW, *Editor*

Light Up With Politics

IT IS very evident that the utility business is in politics. And present political influences are destructive to private ownership and operation and favorable to public ownership and operation. These conditions result from the political exploitation of a hostile public sentiment and can be changed only by bringing into play the same kinds of social and political forces that have placed the business in its present hazardous position. This means that the utilities must take political action. Upon a platform of public interest, utility men as taxpayers, as citizens, as representatives of employees and investors, and as public service suppliers must make politics their major concern. This does not mean potshotting at agitators, at radical politicians, placing definite facts in pamphlets for public distribution, an advertising campaign or a lobbying contact with legislative bodies—these are incomplete, incorrect and amateurish. It means a complete and thoughtfully prepared political program that is applied honestly and continuously in each community served, as well as in the state and national political forums. It means a strong organization based upon political competency; it means definite political action in the political arena.

Public sentiment creates the structures upon which politicians rise to eminence, and the utilities must act upon this concept. They must gain public favor to earn fair political treatment. This is the essence of their political program. Every executive or manager in each community served must devote his individual efforts to making the citizens and the politicians friends instead of enemies; to making them understand his personality, his business, his problems and his intimate and necessary association with every activity that makes for community progress. These utility men must come to know intimately the present municipal officials and state and national legislators, also those who will attain these political positions in the future, and they must be able to convince these men of their political impartiality and at the same time gain recognition that they are honest, that they favor all programs for community development and that a prosperous and fairly treated utility under their competent management is a community asset and in the public interest. Utility executives must think and act externally with respect to their properties and honestly, frankly and sincerely endeavor to become leading citizens instead of selfish property managers only.

This program will succeed or fail depending upon the personnel that applies it. Executives must like to do this work and know how to do it. This calls for a type of man quite different from those who built and expanded the physical plant of the utilities and instituted their operating organizations. It calls for a different kind of knowledge and competency than that necessary to success in finance, engineering, or management. Both education and replacement of personnel must be used to create these new leaders necessary to attain the industry objectives. For no one but chief officers can do this work, can personalize the utilities in each community, can take the lead in the political activities. These are new and quite different specifications for executive

competency, but they must be met if present conditions are to be changed for the better.

But a political program does not stop with the selection of a staff of executives or their action in the political arena. There must be other workers. Each employee of the utilities, each member of the manufacturing, wholesaling, contracting and retailing branches of the electrical industry must be enrolled and put to work. Their efforts must be exerted effectively and honestly and in accord with a plan that is sufficiently flexible to fit local and national conditions. At the start these people must be convinced that the cause is just, that the work is necessary, and that the plans will get results. They must be told how to be effective but non-partisan political workers on matters pertaining to the utility business or those involving community well-being. They also must like to do this work, be sincere in it, and be enthusiastic subordinates in the co-ordinated program. Add to these elements publicity, advertising, fact-finding and other essentials of a good political organization and one gains a conception of the magnitude and complexity of the task confronting the utilities and the industry.

Fortunately it is not necessary to undertake the work by establishing a national headquarters or a national organization. If the actions outlined are undertaken on each property for every local community the national situation will take care of itself; it is the district organizations that win elections. What needs to be done is to staff each local property with "political" executives and permit them to build their political fences. This does not involve spending money, artificial or underhand tricks, or any other action than work by them and the local electrical industry employees to measure up to the meaning of good citizenship and to gain the friendly confidence and understanding of utility customers and local politicians by showing that that they are doing an honest and constructive job that is in the public interest. Success in politics depends upon human relations, and these have their greatest center in the homes of the citizens of each locality. Utilities should translate public service into political service also by taking local action adequate to meet present needs. Local tickets should be slated and local platforms written at once for each community.

Utilizing opportunities for broader engineering analysis

Relaxed pressure upon engineers to complete electrical construction as rapidly as possible over wide areas of service has released time for more extended analytical studies of system development. Specific examples of work being done to insure a better balanced development of plant are of interest in this connection. New business is receiving more attention from the standpoint of ultimate demand as well as initial requirements, and the relation of load-supplying facilities in districts as a whole to neighborhood necessities is being considered more carefully. The limitations of distribution facilities in particular areas are being studied with reference to system development programs and such inquiries are often set in motion by sales department activities in a very limited locality. Problems of standardizing transformer sizes for secondary networks and local substation service, voltage regulation, selection of cable types and unification of distribution equipment and applications are much to the fore.

Other matters receiving more leisurely but none the less penetrating attention include the co-ordination and simplification of field construction procedure to cut labor and material costs; the investigation of equipment obsolescence and study of replacement schedules, and the examination of plant records to reduce maintenance costs by combining overlapping and infrequently used records, as well as eliminating obsolete records and practices in construction and operating accounting. Co-operative conferences are being held with manufacturers, dealers, jobbers and contractors with the object of reducing installation costs without sacrificing service quality, and the importance of adequate wiring with a view to the future installation of air-conditioning equipment in public and semi-public buildings is being considered in progressive circles. Such tasks are doubly useful in occupying engineering forces before the present rapid upswing of new service demands quickens the pace of electrification in industry and commerce and in laying firmer foundations for economical development under the present favorable cost and time conditions. Rehabilitation starts with engineering analysis.

THE WEEK

Spokane Utility Fights Municipal License Tax

Stipulating twenty reasons why the law is illegal and void, an injunction suit against the 3 per cent gross revenue occupation or license tax of the city of Spokane (ELECTRICAL WORLD, August 19, page 228) has been filed by the Washington Water Power Company. The suit alleges discrimination in that the gas company, a competitor of the electric utility, is taxed only 1 per cent.

Other points of attack are: That the company is subject to control by the state Department of Public Works and that the ordinance would in a measure be reflected in rates over which the city has no jurisdiction; that the tax is in violation of the Constitution of the United States; that the city is invading a field of taxation barred to it by the new state occupation tax; that under the franchise granted the company by the city in 1894 a franchise fee of $2,500 is provided, and that in addition thereto the company pays city, state and county taxes, leaving no opening for the city to collect additional levies.

The Spokane ordinance is similar to one adopted by the city of Seattle in 1932, which has been upheld by the state supreme court and is now on appeal to the U. S. Supreme Court.

A show cause order against the city was issued by Judge Charles H. Leavy restraining the city from taking further action toward the enforcement of the ordinance against the power company until further order of the court.

▼

Untendered Resignation of Commissioner Accepted

Failing to secure the resignation of Federal Trade Commissioner William E. Humphrey, who maintains that the presidential power of removal from that office is dependent upon demonstrable "inefficiency, neglect of duty or malfeasance in office" and not upon political exigencies (ELECTRICAL WORLD, September 23, page 390) President Roosevelt "accepted" Humphrey's untendered resignation. Communications this week released to the public indicate that Mr. Humphrey definitely refused to accept the implied acquiescence, concluding: "My resignation, after this wide publicity, would be, in my opinion, a great injury to the commission and to the public."

To this the President replied: "Effective as of this date you are hereby removed from the office of commissioner of the Federal Trade Commission."

Mr. Humphrey is reputed about to take the matter to court and prevent the succession of G. C. Matthews under *quo warranto* proceedings.

Meeting this week, the Federal Trade Commission found Mr. Humphrey in his usual place, where he remained throughout a two-hour session. His appointed successor did not attend. The commission, however, voted to recognize the validity of the President's removal order and declined by resolution to further recognize Mr. Humphrey as a member.

▼

Red River Hydro Project Opposed in Oklahoma

Opinion of officials in Oklahoma is not united on the proposal for construction of a large dam on the Red River near Denison, Tex., designed to form a large lake along the Red and Washita rivers 45 miles in extreme length and 20 miles wide at the widest point and to cost $36,000,000 (ELECTRICAL WORLD, July 29, page 137).

Engineers from Dallas sponsoring the project, along with representatives from southeastern Oklahoma and northern Texas and several Congressmen from both states, think the project would give work to 4,000 men and would be a source of electric power which could be sold to the large electric companies of Oklahoma and Texas, or, if such companies did not want it, direct to municipalities in both states.

Governor Murray has announced his opposition to the project on the grounds that construction of the lake would inundate large areas of Oklahoma farm lands which are needed, and produce power, of which there already is a surplus.

▼

Birmingham Votes Down Municipal Plans

REVERSING a widespread trend in the vicinity of Muscle Shoals toward municipal ownership and operation of electric utilities, Birmingham, Ala., voted down such a proposal by 10,034 to 7,004 in an election this week. Birmingham is a city of more than 250,000. The Birmingham Electric Company has approximately 50,000 meters there. At the same time the city disapproved the plan to take over and operate the water plant 10,082 to 6,450, the street railways 12,401 to 3,840 and the central heating plant 12,148 to 3,807, the latter two operated by the Birmingham Electric Company in conjunction with the main business of distributing electric light and power.

The issue was warmly contested in Birmingham, headquarters of the Alabama Power Company though not served by it, and of all the cities or towns in the state to vote on the question it is the only one except Homewood, a suburb, to vote down municipal ownership. Ten smaller towns have decided to go into the power business, all with the hopes of obtaining cheap current from Muscle Shoals.

Cheaper electric rates from Muscle Shoals were offered Birmingham voters as the chief prize for ratification of the proposal, while opponents pictured increased taxes, inefficient management and "political" control. The estimated cost of a municipal plant was placed at $25,000,000 to $40,000,000, for which a bond issue would have been necessary. Those favoring private operation contended the city would have been unable to float such a bond issue without an increase in taxes. Tacoma, Wash., was cited as an example of efficient municipal operation, but opponents claimed Tacoma's tax rate was $9 per $1,000 of assessment, compared to $3.60 in Birmingham.

Opposition organized

Stockholders of the Alabama Power Company in meeting last week in Birmingham organized to fight the movement toward municipal ownership of utilities in Alabama. Dr. J. D. Heacock of Birmingham was elected permanent chairman. The company was urged to join in the fight for continued private operation and through newspaper advertisements to show the falsity of some of the claims being made by the advocates of municipal ownership.

Short-Circuit Laboratory Opened in England

Completion of a test laboratory in which equipment may be subjected to full-scale, short-circuit conditions has been made for A. Reyrolle & Company at Helburn-on-Tyne, England.

Complete with a 40,000-kva., 40-cycle, 2,400-r.p.m. steam generator, a 1,200-hp., 550-volt motor and all the familiar appurtenances of transformers and control apparatus, this station has been used thus far in short-circuit tests involving as high as 350,000 kva. at 38,000 volts and 1,000,000 kva. at 66,000 volts.

In addition to short-circuit investigations the plans can be used for testing transformers, reactors, fuses, etc., and for obtaining data about electric arcs, the forces set up by heavy currents and the behavior of protective devices.

Besides being the pioneer plant of its kind in Great Britain it will claim to rank, when the present extensions are completed, as the largest and best-equipped short-circuit testing station in the world. A second generator of 40,000 kva., 50 cycles and operating at 3,000 r.p.m. is now being installed.

▼

Georgia Sells Ranges, Lamps and Refrigerators

Entering upon its system-wide load-building campaign, planned to add $767,000 annual revenue (ELECTRICAL WORLD, August 26, page 261) Georgia Power Company's sixfold sales plan is getting well under way.

To add 900 electric ranges to the lines between October 2 and November 11 employees are being thoroughly organized. To encourage employees to sign up for electric equipment in that interval the company will provide free wiring of range or water heater facilities, making no addition to regular monthly rentals.

Present users of electric ranges, 12,000 of them, are being asked to cooperate through a customer-indorsement activity. Each prospect-sale name submitted is worth $3 in cash or merchandise credit to customer participants.

In the first two days of a lamp campaign 4,626 lamps were sold out of a total quota for the October 2-31 campaign of 60,000. Liberal commissions (20 cents a carton) encourage activity.

In the midsummer refrigeration campaign sales totaled $204,489, or 134 per cent of quota.

▼

New Professional Federation

On a platform seeking to establish a definite program to put men to work, inaugurate a live organization to promote the interests of technical employees, bring all classes of technical employees into accord for their economic protection, endeavor to better conditions and wages among both privately employed and civil service men, and organize adequate relief and protection for the unemployed, a Federation of Architects, Engineers, Chemists and Technicians has been formed in New York. It is planned to undertake a national movement. Groups are organizing in other cities.

▼

Progress in Identified Cord

Rapid progress in the identified cord movement is reported by the Electrical Cord Manufacturers division of N.E.M.A. Latest figures show the plan to be in effect in 1,000 communities, including 77 major cities. As a result more than 75 per cent of the cord sold today is of the approved type, whereas a year ago but 25 per cent was approved.

▼

500-Kw. Radio Transmitter

Rapid progress on the new 500,000 watt broadcasting station WLW of the Crosley Radio Corporation in Cincinnati is reported. This will, it is said, be the most powerful plant of its kind yet built. A vertical radiator antenna tower 831 ft. high has been erected. A service zone of 2,500 miles will be covered but broadcasts will be audible under favorable conditions to listeners in virtually any part of the world. The cost of the installation will be about $400,000.

▼

Earth-Generated Steam for California Electricity

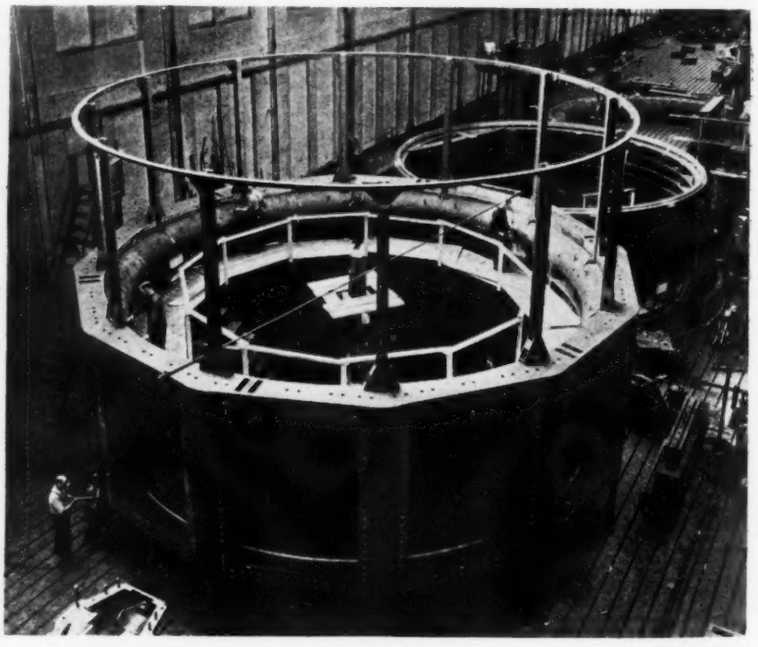
Application of earth-generated steam to the commercial operation of an electric light and power operation in California appears imminent. Healdburg, served by Pacific Gas & Electric Company at an average rate of 1.35 cents a kilowatt-hour, has contracted for 20 years for service beginning September 1, 1934, with the Old Geysers Development Company for energy at 1.1 cents for the first 2,250,000 kw.-hr. annually. The schedule thereafter graduates downward at the rate of one-quarter mill for each 250,000 kw.-hr. additional to a lower limit of 9 mills for all above 4,000,000 kw.-hr.

It is claimed that with present steam wells a total load of about 67,000 hp. is possible. Initial installation will be of two 1,000-kw. generating units, one of which will be for standby service. Installation costs as low as $30 a kilowatt have been discussed.

General plans of the Old Geysers Development Company are said to be not dissimilar from those of existing and proposed Italian projects (ELEC-

▼

Intake Tower Gates for Boulder Dam



Westinghouse

More than 4,000,000 lbs. of material will be incorporated in the eight intake gates for Boulder Dam. The first, a 523,858 lb. assembly, is shown before shipment. Welding has been widely used. The completed gate is 25 ft. high and 37 ft. in diameter.

TRICAL WORLD, September 24, 1932, page 393, and August 26, 1933, page 258). Commercialization of the by-product helium and carbon dioxide is planned.

▼

Disputed Fund Tied Up; Middle West Bankruptcy Off

Insisting that Samuel Insull was using the name of Constantine S. Eftax, a Chicago druggist of Greek birth who has returned to that country, to cover a secret fund in the Harris Trust & Savings Bank, Attorney Samuel A. Ettelson, representing Gus Lowry, holder of $6,000 debentures of the Corporation Securities Company, has succeeded in obtaining a temporary restraining order pending his effort to show that the fund was Mr. Insull's and should be held for creditors of the bankrupt company.

Earlier Mr. Ettelson had charged that a secret "million dollar" fund was being held in the name of Eftax for Mr. Insull. The bank answered that Mr. Eftax was not representing Mr. Insull, to the best of its knowledge, but had $85,000 in securities in the bank and $16,000 cash (ELECTRICAL WORLD, October 7, page 453).

During the week the protective committee for the Middle West Utilities Company noteholders withdrew its petition filed last March in support of the bankruptcy petition which had been filed in April, 1932. At the same time the committee filed a motion for leave to intervene in opposition to bankruptcy. Judge Wilkerson took the motion under advisement.

The proposed action on collateral of the Insull Investment, Inc., and the Corporation Securities Company held by New York banks has been postponed until November; this delay marks the forty-first postponement.

▼

Regulation of Utilities Sought in Texas

Legislation which would not only place all public utilities under the Texas Railroad Commission in matters of rates and service regulations but would also levy on them a gross receipts tax to support the commission has been introduced in the state legislature.

Sponsored by 53 members of the House of Representatives the bill is seen to have formidable support. It is contended that such a law is neecssary to comply with the National Recovery Act and program of President Roosevelt. The bill would levy a tax of one-eighth of 1 per cent of the gross receipts of public utilities for support of the commission in rate investigations. Provision is made for employment of expert engineers, examiners and accountants. The commission is limited to an expenditure of $100,000 per year in public utility rate investigations.

Waiting for Developments

Business indicators point strongly to watchful waiting. The delicate and much-manhandled balance of trade needs but a breath to speed improvement or precipitate decline. Were encouraging and likely-to-be-sustained policies on the currency announced, some see large gains toward better conditions assured. Were credit policies made widely broad and free, nervous reactions might shatter hard-won gains. October is still likely to be an important month.

Current figures show no strong trends for better or worse. Carloadings up 1.4 per cent from the previous week (and 6.5 per cent over a year ago), but ordinarily successive October weeks show larger gains. Bituminous coal, reversing its course for the preceding week, shows gains as strike interruptions grow fewer. Automobile production shows adherence to levels of the past September. Steel production off. Retail sales reports for early October show dollar sales steady. Chain-stores report dollar sales off about 5 per cent. Buyers for merchandising groups cautious as extent of consumer revolt remains to be seen. General indexes show appreciable rallying tendency. Stock prices still reflect late rally last week. Commodity prices during the week fell somewhat below September peak.

Third quarter earnings are expected to be encouraging for such improvements as have been made will be only slightly affected by recent and higher costs under NRA. Administration statement regarding opening of March-closed banks looked for. Inflationist block, quieted by Presidential request, plans full pressure on Congress. $400,000,000 road relief appropriation goes a-begging for takers and finds few. National Industrial Conference Board reports rise in cost of living to wage earners for fifth consecutive month; and 9 per cent over April low.

▼

More Power Recommended for State Utility Boards

At the opening session of the annual convention of the National Association of Railroad and Utilities Commissioners held this week in Cincinnati a declaration that "if our house needs cleaning, let's clean it" was made by E. J. Hopple, chairman of the Ohio Public Utilities Commission. Maintaining that the commissions' function was "the stabilization of public confidence in the utilities, he proposed three changes in the present status of commissions. First, a grant of larger discretionary powers for the commissioners; second, better regulatory legislation of the utilities, and, third, an exposé of political racketeering wherever it existed.

H. Lester Hooker of Virginia, president of the association, stated that the system of state regulation, built up in the last thirty years, was now being attacked by those who favor public ownership and operation. "On the side of those who aim to destroy the present system of regulation," he said, "are lined up those who seek to undermine the sovereignty of the states by strengthening the force of the federal arm, by extending federal regulatory powers over utilities operating within the states, in usurpation of the authority of the state commissions. At least some of the proponents of this policy are actuated by the desire to weaken, to discredit, and finally to replace state regulation as a step toward the concentration of regulatory powers in Washington and ultimate government ownership and operation."

Battery Code Signed; Washer Hearings Completed

Little is heard of the electric light and power, electrical contractors, electrical wholesalers or similar NRA codes at present. Hearings have not been scheduled in the case of the first and third. Hearings have not been completed in the case of the second.

President Roosevelt last week signed the code submitted by the oil burner industry and this week that of the National Battery Manufacturers Association, representing the makers of electric storage and wet primary batteries. The latter provides: Average 40-hour week, not more than 48 hours in any one week or eight hours in any one day for factory employees; average 40-hour week for other employees, except managerial, executive, technical, emergency crews, etc. Minimum wage for factory workers 40 cents per hour unless the rate on July 15, 1929, was lower, in which case not less than the latter rate, but in no event less than 90 per cent of the minimum established herein; learners to be paid not less than 80 per cent of such rate.

Hearings before Assistant Deputy Administrator B. W. Murray on the code for the washing and ironing machine industry set a record in consuming but 29 minutes, said to be the shortest public hearing so far. About 98 per cent by volume of output of the industry was claimed to be represented.

Professional engineers of the construction industry, represented by the American Society of Mechanical Engineers, American Association of Engineers, American Institute of Consulting Engineers and American Society of Heating and Ventilating Engineers, have through the American Society of Civil Engineers submitted a code scheduled for hearing this week.

Coming Meetings

Association of Iron and Steel Electrical Engineers — Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

American Society of Mechanical Engineers—New York, N. Y., December 4-9. C. W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers—New York, N. Y., January 23-26. H. H. Henline, 29 West 39th St., New York.

▼

Nebraska Commissioners Debate Their Jurisdiction

Majority members of the Nebraska Railway Commission have refused consideration to an order to show cause drawn by Commissioner Bollen, who desires power companies to file periodical reports of revenues and expenses and complete schedules of rates charged in various municipalities and farmers served.

Chairman Randall states that the constitution does not give to the commission the general powers over public utilities that it gives over common carriers, and that the legislature has several times refused to specifically grant it any regulation of power companies apart from supervision of security issues. He assumes that the order would involve a usurpation of power certain to be resisted. The majority of the commission appears firmly convinced that the legislative policy has been clearly expressed in its various acts, which reserve control of rates and services to municipalities, and that no further steps would be taken in the matter. Chairman Randall gave it as his opinion that the power companies would be certain to win in the courts.

▼

Crisp County Judgment of $147,684 to Builders

Georgia's long-suffering, public excursion into the light and power business, the Crisp County Power Commission, sustained another blow last week when Federal Judge Bascom S. Deaver signed a judgment for $147,684.86 against Crisp County and the Commission in favor of S. J. Groves & Sons, builders of the county's hydro-electric power dam.

The amount of the judgment represented balance due, principal and interest, on an $801,989.88 contract for the construction of the dam. Interest from Aug. 1, 1930, amounts to $18,922.32. Signing of the final decree in the case ends litigation here which was started more than a year ago in the Americus division of United States district court.

Counsel for the power commission and Crisp county state appeal will be made from Judge Deaver's decision to the fifth circuit United States court of appeals. Holders of bonds totaling $1,250,000 and secured by the enterprise are protected as the judgment does not pre-empt their prior lien.

The commission claims the bond fund to have been exhausted and holds that the judgment cannot legally be collected out of the county's general fund. The commission lost something less than $70,000 in a bank failure and otherwise depleted its funds, it is said, through the purchase of additional machinery and extras.

▼

Progress and Hope in Electrometallurgy

COINCIDENT with the convention of the American Welding Society in Detroit last week there was held the National Metal Congress, in which the welding society, the American Society for Steel Treating, the American Institute of Mining and Metallurgical Engineers, and the American Society of Mechanical Engineers collaborated. No spectacular disclosures of new things were evidenced, but continued progress in the art was. An exposition was held in which nearly 150 exhibitors, producers of ferrous and nonferrous metals and manufacturers of all types of equipment for metal treatment, fabrication and finishing participated. These exhibitors saw enough good business ahead to justify money being spent in going after it and brought a strong note of optimism to a group whose industry has long been in the doldrums.

As to specific electrical developments, largely reported upon in the program of the American Welding Society with a couple of papers on electric heat in the sessions of the American Society for Steel Treating, there was emphasis on that phase of metallurgical activity. In the Welding Society program resistance welding was given the prominence of a session by itself. Four papers on control and timing methods, by H. W. Roth, Controlweld, Inc.; O. C. Frederick, General Electric Company; C. Stansbury, Cutler-Hammer, and D. C. Wright, Electric Controller & Manufacturing Company, were presented. The Roth paper dealt with automatic controls, especially for spot welding, as maximum current, straight time, time-current and differential time methods, and described the development of synchronous mechanical controls for spot and seam welding. Mr. Stansbury discussed precision spot welding with tube controlled contactors, described methods of checking accuracy of results and presented data indicating the feasibility of operating magnetic contactors to open at the point in the supply voltage wave to result in minimum arcing. Mr. Wright talked of timing spot welders with respect to current flow in order to secure uniform welds regardless of voltage changes or variations in resistance of the welding circuit. With high resistance or low voltage, current is so reduced that a fixed invariable time will not allow sufficient heat units to the weld. Automatic time adjustment dependent on value of current makes the time directly and inversely proportional respectively to resistance and voltage of the welding circuit and thus puts the same amount of heat into every operation of the welding machine.

Limitations of X-ray inspection

In piping for steam at 600 lb. pressure and 850 deg. F. temperature, the operator demands assurance of safety and to give him that in welded piping X-ray inspection of welds is frequently made. But although the X-ray will reveal inclusions and defects of metallic structure in a weld it will not clearly show, nor in all cases even indicate, places where surfaces are merely in close contact and not fused together. The limitation of X-ray inspection was brought to the fore by A. S. Douglass, the Detroit Edison Company, who told of test welds being sent to three different laboratories for radiographs, in none of which was the lack of fusion between contacting surfaces detected. In discussion of this paper it was stated that gamma rays were more effective than X-rays in revealing this condition, and also that a condition of porosity in one and not in the other of the contacting surfaces was good grounds for suspicion that the surfaces were not joined.

Difficulties of electric arc welding under water and methods for overcoming them were described in a paper by N. S. Hibshman, C. D. Jensen and W. E. Harney, all of Lehigh University. How good is weld metal as a part of a magnetic circuit? In an electrical machine it is necessary to locate welds at points where they will be called on to carry little or no magnetic flux? What can be done to improve the magnetic characteristics of metal deposited by welding? The answers to these questions were sought in an investigation of magnetic properties of weld deposited metal at Rensselaer Polytechnic Institute reported by W. F. Hess. The investigations showed the advantages of atomic hydrogen welding and of various heat treatments in improving the magnetic characteristics of weld metal. The effects of metal-arc welding on galvanized steel and of the galvanizing on the weld were reported by Leon C. Bibber, Navy Department. From many studies

it was found that the heat of welding, even though it apparently burned off the galvanizing, affected the corrosion resisting property very little if at all. It was also found that the strength of welds was little affected by the zinc. The great problem in the welding of galvanized materials is the physiological effect of the zinc fumes on the welder.

Heat-treating has been speeded

Only recently has cast iron been recognized in its true light as one of the most complex alloys used by man, said C. H. Morken, Detroit Electric Furnace Company, in a paper on the heat treatment of cast iron at one of the sessions of the American Society for Steel Treating. Mr. Morken showed that this recognition and the great improvements in cast iron quality that have resulted from it are largely due to the electric arc furnace. The ability of the electric arc furnace to super-heat the iron and thoroughly to mix its constituents together has resulted in radical revision of cast-iron heat treating methods, particularly in the shortening of the time required for such treatment. At the same session R. L. Dowdell, University of Minnesota, presented the results of studies in the aging of miscellaneous steels when treated for permanent magnets. Tempering at 100 deg. C. for twelve hours, followed by tempering in the magnetized state until about 5 per cent of magnetic induction is lost, followed further by the sacrifice of 5 per cent more in a demagnetizing field, resulted in the greatest magnetic stability of any of the treatments studied. This treatment indicates that both hardening and magnetic strains should be partially removed in order to stabilize permanent magnets regardless of their composition.

▼

Kansas Rehearing Denied

Back to the Kansas Supreme Court went its decision holding the anti-merchandising law of the state to be unconstitutional (ELECTRICAL WORLD, June 17, page 777) with a petition for rehearing. This week the court denied that appeal, made to it by Roland Boynton, Attorney-General.

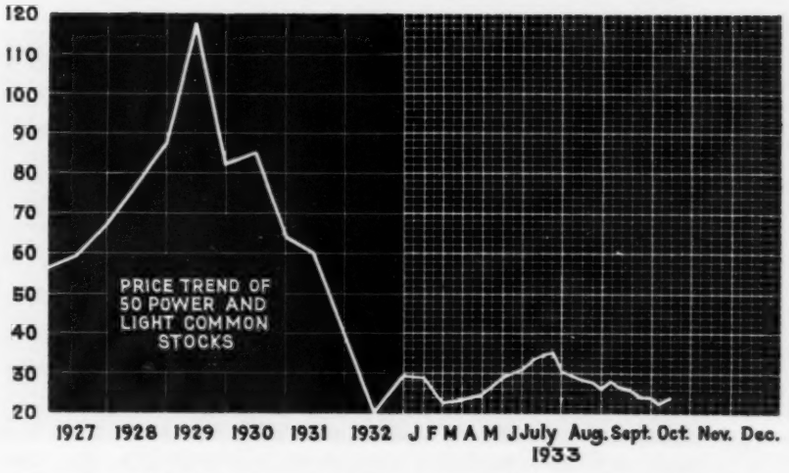
In order to simplify the action for rehearing eleven cases involving the same number of companies were combined into one test case. It was this which has just been turned down.

▼

$27,800,000 for Los Angeles?

Los Angeles, Calif., has filed with the California Advisory Board, Federal Public Works Administration, a request for $27,800,000 with which to construct additions to its water system and to acquire additional lands and water rights necessary for the projects. Lands and water rights of the Southern Sierras Power Company in the Mono Basin are proposed to be acquired and property of the power company on the Owens River Gorge. The project includes: Mono Basin project, $5,368,000; Long Valley dam, $1,107,000; Los Angeles aqueduct additions and enlargements, $586,000; Bouquet Canyon dam, $1,700,000; distribution system, $11,213,000; equipment, $834,000; engineering charges, $476,700, and legal administration and other overhead charges, $4,725,000.

Stock Price Trend Reversed



For the third time since last July, when utility securities began a long decline, the "Electrical World" light and power common stock average has shown resistance to further fall. Average this week 24.4; last week 23.3.

▼

Associated Retorts to Complexity Charge

Newly retained as counsel for the Associated Gas & Electric Company, P. J. Hurley, formerly Secretary of War, appeared before the Senate committee investigating stock market practices late last week in defense of that utility system.

Ferdinand Pecora, alleged to have endeavored unsuccessfully to subpœna H. C. Hopson, Associated vice-president, was assured that the latter would accept service. Following an attack on Associated by Mr. Pecora, Counsel Hurley declared: "Large interests would like to see the Associated Gas & Electric Company 'dismembered,' and added that 'the largest public utility company in the country' was not controlled by banking interests close to Wall Street. 'So-called chiselers' have formed committees ostensibly to serve the company's security holders, but actually to profit by 'the distress' that might be brought to some 350,000 of them," he said.

In a letter to stockholders J. I. Mange, president, this week pointed out that Mr. Pecora's characterization of "corporate labyrinth" "could not but create the unfortunate and unwarranted impression among investors and the general public that the Associated Gas & Electric Company is alone, among public utilities, complex in structure and subject to the same defects which brought the other (Insull) group into the hands of receivers." Mr. Mange pointed to the elimination of more than 100 underlying issues of bonds and preferred stocks retired by Associated since 1925, showed that since 1922 over 200 corporations included in the system have been eliminated by merger, consolidation or sale of assets and concluded:

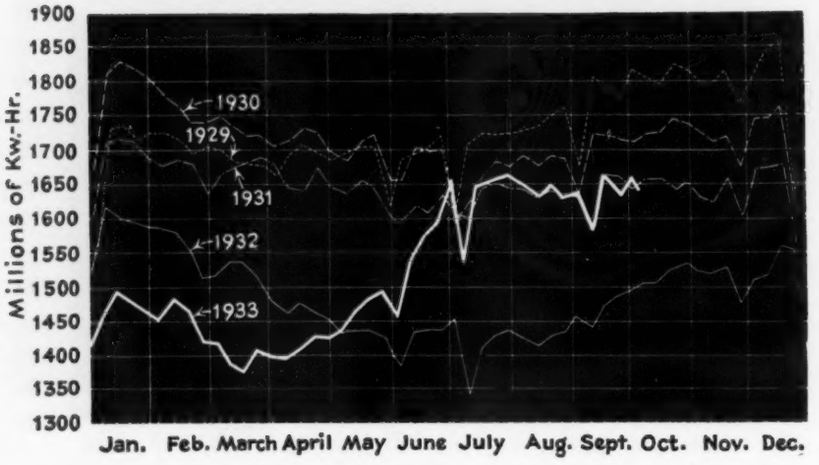
"If the Associated Gas & Electric Company should find itself unable to meet its fixed interest charges, it will not be the result of any complexity of structure or similarity in any respect to the group mentioned by Mr. Pecora, but the result of the mounting taxes which utilities have had to face, the direct and indirect costs of cooperating with the NRA and the frequent unwillingness of public service commissions to allow what has always been considered a reasonable return after operating expenses and taxes."

▼

Power Irrigation Plans Backed

Public works boards of the six states of Nebraska, Iowa, Minnesota, the Dakotas and Wyoming have voted to back the four Nebraska combination power-irrigation projects, to cost $33,000,000, at a meeting in St. Paul. All of the states' representatives backed all of the proposals of the respective states represented.

Output Hovers Around 1931 Level



In the game of leapfrog the weekly figures are playing with those for 1931 central station energy output, for the first week of the current month was on the under side, with a production of 1,646,136,000 kw.-hr., according to the Edison Electric Institute. In the preceding week the new figures were on top. Thus the approximate equality with operations two years ago continues.

Compared with 1932 the increase for the week ended October 7 was 9.3 per cent, or about one per cent less than for the week of September 30. Regional gains remain highest in the Rocky Mountain and Southern states, with the Central industrial area still doing better than the country as a whole.

Weekly Output, Millions of Kw.-Hr.

1933		1932		1931	
Oct. 7..	1,646	Oct. 8..	1,506	Oct. 10..	1,653
Sept. 30..	1,653	Oct. 1..	1,499	Oct. 3..	1,646
Sept. 23..	1,639	Sept. 24..	1,491	Sept. 26..	1,660
Sept. 16..	1,663	Sept. 17..	1,476	Sept. 19..	1,663
Sept. 9..	1,583	Sept. 10..	1,424	Sept. 12..	1,582

Per Cent Change from Previous Year

Region	Week ended Oct. 7	Sept. 30	Sept. 23
New England	+ 8.4	+ 8.0	+ 8.6
Middle Atlantic	+ 4.5	+ 5.7	+ 4.7
Central industrial	+10.5	+12.7	+13.5
West Central	+ 1.3	+ 3.0	+ 3.5
Southern States	+14.8	+15.8	+11.7
Rocky Mountain	+22.8	+29.4	+28.0
Pacific Coast	+ 2.7	+ 1.9	+ 1.3
United States	+ 9.3	+10.2	+ 9.9

▼

T.V.A. Calls for Bids for Line Conductors

Bids for 675 miles of copper conductor for the tie transmission line to connect the Muscle Shoals power plant with Norris Dam near Knoxville, have been called for by the Tennessee Valley Authority. According to David E. Lilienthal, power director, this is the first of two transmission lines to be erected. While this line will furnish the energy necessary for the construction of the Norris Dam, it is intended primarily as a tie line to connect the Wilson Dam power plant with the generators later to be installed at the Norris Dam. Later another line will be constructed along a different route so as to afford a wider distribution of power as well as to provide against interruption of service due to storms or accidents.

Arthur E. Morgan, chairman of the Tennessee Valley Authority, stated after a conference of the directors of the authority with President Roosevelt last week, that between $3,500,000 and $4,000,000 had been allocated from authority funds for construction of a fertilizer plant at Muscle Shoals.

Whether the sum would be expended on fertilizer works at the Muscle Shoals nitrate plant, Chairman Morgan said, depended on the outcome of experiments now being conducted in Washington and at Muscle Shoals.

▼

Philadelphia Show Sets Sales and Attendance Mark

Scarcely outdone by the recent National Electrical Show in New York (ELECTRICAL WORLD, October 7, page 452), the success of Philadelphia's sixth annual electric and radio show, according to G. R. Conover, director, "surprised every one connected with it."

"Not only was attendance greater than in former years," stated Mr. Conover, "but a check-up of exhibitors revealed a tremendous volume of business which was traced directly to the show."

Horace P. Liversidge, president of the Electrical Association of Philadelphia, said: "There was more interest and actual sales this year than in any former show in which the association has been represented. It shows that the electrical industry is definitely on the up-grade."

More than 100,000 persons visited the show. Exhibitors did business estimated at nearly three-quarters of a million dollars.

▼

Manitoba Makes Power Survey

Power needs of Manitoba's northern mining developments have been surveyed by the Manitoba Government. Construction of a hydro-electric plant to serve the Island and God's Lake areas will probably be completed early in 1935, according to an announcement by the provincial Department of Mines and Natural Resources. The survey disclosed that 20,900 horsepower is available on the Island Lake river.

▼

Light and Power Census Preliminary Reports for Five States

Preliminary reports based on the 1932 census of electric light and power companies are being issued by the Bureau of the Census in rapid succession. Summaries for Montana and Nevada were published in the ELECTRICAL WORLD of October 7, page 456. Summaries covering five other states are listed here. Additional figures will be published as they are received from the Bureau.

	New Jersey		Massachusetts		Utah		Connecticut		Wyoming	
	1932	1927	1932	1927	1932	1927	1932	1927	1932	1927
No. of reporting establishments	25	29	113	123	45	46	31	37	44	42
Commercial	13	13	70	77	13	17	25	31	32	28
Municipal	12	16	43	46	32	29	6	6	12	14
No. reporting distribution only	12	14	71	73	19	23	13	14	15	15
No. of customers	1,099,750	981,040	1,206,508	1,078,007	.....	.....	.....	.....	.....	.....
Prime movers, total hp	1,426,145	1,003,561	1,590,644	1,528,568	201,115	198,846	679,818	603,369	50,364	48,166
Steam turbines, hp	1,413,650	959,140	1,305,416	1,287,207	54,666	48,240	562,181	514,181	37,124	34,334
Steam engine, hp	1,450	33,863	41,613	51,421	.....	50	350	2,513	4,637	5,340
Int. comb. eng., hp	4,100	3,307	7,225	1,420	6,261	1,950	1,600	675	5,650	4,769
Hydro turbines, hp	6,945	7,251	236,390	188,520	140,188	148,606	115,687	86,000	2,953	3,723
Generators, kw	1,062,445	638,876	1,156,034	1,077,337	137,199	132,755	502,686	415,940	36,272	34,748
Output, thous. kw.-hr	2,290,679	1,861,985	2,158,486	2,245,301	275,846	340,873	917,571	968,182	74,597	67,070

Missouri Court Restrains Municipality in P. W. A.

Maintaining that the section of the federal public works act authorizing the lending of money by the Federal Emergency Administration of Public Works to municipalities barred by state constitutions from borrowing is invalid and of no force and effect in Missouri, Circuit Judge J. H. Bowron granted the injunction reqested by J. W. Hagler, a taxpayer, who sought to restrain the city of Salem from borrowing $40,000 (ELECTRICAL WORLD, September 30, page 427).

After the city had filed the application for the loan for extensions to the municipal water works and light plant and the application was approved and forwarded to Washington for final action the injunction was sought on the grounds that the contemplated debt violated the Missouri Constitution, which prevents any municipality from becoming indebted in any manner for an amount greater than the revenue for one year, except by a two-thirds favorable vote of the persons voting on such proposal. He further contended that even if the two-thirds favorable vote had been obtained, the loan with other existing indebtedness would raise the city's bonded debt beyond the 5 per cent of assessed valuation for general purposes, plus an authorized 10 per cent for municipally-owned utilities, provided for in the Constitution.

Counsel for the city at the hearing before Judge Bowron argued that the loan was not a debt within the meaning of the constitution, since it was proposed to repay the sum out of plant earnings and not by taxation. Judge Bowron held that a federal loan obtained under the emergency act was a debt within the meaning of the Constitution of Missouri and that no city or town in the state may borrow from the federal government any sum that is in excess of the city's anticipated revenue for one year. Dr. G. H. Slawson, Mayor of Salem, said the city would appeal to the Missouri Supreme Court.

▼

Thirty Barrels an Hour, Electrically

Automatic barrel-making machines of the electric welding, unit type have a nominal capacity of 30 or more barrels an hour; many times the daily figure indicated in our September 30 issue, page 427.

▼

New Offer Made on Mono Basin

An offer to purchase the Mono Basin and Owens River lands and water rights of the Southern Sierras Power Company for $6,500,000 was made to the company October 3 by a joint committee of Los Angeles, Calif., city officials and the municipal water and power department. The offer of the city was a counter-proposal offering $450,000 less than the amount for which the company previously had agreed to sell (ELECTRICAL WORLD, July 22, page 100).

▼

General Electric Orders Increase 70 per Cent

Orders received by the General Electric Company for the third quarter of 1933 amounted to $43,733,499, compared with $35,539,858 for the second quarter of this year and with $25,665,402 for the third quarter of 1932, an increase over last year of 70 per cent.

For the nine months ended September 30 orders received this year amounted to $104,785,001, compared with $94,374,114 for the first nine months of 1932, an increase of 11 per cent.

▼

Cutler-Hammer Shipments Up

For the quarter ended September 30, 1933, net shipments of Cutler-Hammer, Inc., amounted to $1,170,512, as compared with $700,914 in the similar period of 1932. For the nine months ended September 30 net shipments were $2,607,452, against $2,311,263 in the first nine months of 1932.

▼

Silver Creek Project Advancing

Negotiations have begun between officials of the Sacramento Municipal Utility District and the Pacific Gas & Electric Company regarding the construction of power plants and the purchase of power to be developed in conjunction with the district's proposed Silver Creek water project (ELECTRICAL WORLD, September 9, page 330). An allotment has been made from P.W.A. funds for the construction of the project, although actual appropriation will not be made until certain qualifications, including an election requiring a two-thirds majority for passage of bonds, have been met by the district.

Major New Construction This Week

Transformers and accessories, motors, controls, regulators, conveyors, loaders, etc., will be installed in addition to gold concentrating plant of Noranda Mines, Ltd., Noranda, Que. Cost over $400,000.

Northern Brewing Company, Petoskey, Mich., plans $100,000 expansion.

Youngstown, Ohio, plans city-owned power distribution system with substation facilities. Cost about $500,000. Bond election in November.

Bridgeport (Conn.) Brewing Company plans $100,000 improvement program.

Appropriation of $256,500 has been secured by Army Signal Corps, Washington, D. C., for construction of underground cable and conduit systems at 20 army posts in different States. Bids will soon be asked.

Motors, controls, pumps, substation equipment, etc., will be installed by Midwest Refining Company, Alma, Mich. Cost over $125,000.

Golden West Brewing Company, Oakland, Calif., plans new $250,000 plant at Los Angeles.

Motors, controls, regulators, power station equipment, conveyors and other equipment will be installed in additions to cellulose rayon mill of Tennessee-Eastman Corporation, Kingsport, Tenn. A $4,000,000 project.

Bordentown, N. J., plans city-owned electric light and power plant to cost $104,000. Financing will soon be arranged.

Fairmount Brewing Company, Cincinnati, Ohio, plans new multi-story addition and improvements in present plant. Cost about $200,000.

Glenwood, Minn., plans city-owned electric light and power plant to cost $140,000. Bond issue authorized at special election.

Cedar Valley Distillery, Wooster, Ohio, plans $100,000 expansion.

New York Metal Prices

	Oct. 3, 1933 Cents per Pound	Oct. 10, 1933 Cents per Pound
Copper, electrolytic	9.00	8.75
Lead, Am. S. & R. price	4.50	4.50
Antimony	7.00	6.75–7.00
Nickel ingot	35.00	35.00
Zinc, spot	5.12	5.12
Tin, Straits	48.80	48.25
Aluminum, 99 per cent	23.30	23.30

▼

Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	September 1932	September 1933	Per Cent Inc. or Dec.	Nine Months 1932	Nine Months 1933	Per Cent Inc. or Dec.
New York	222	85	— 61.7	2,189	1,307	— 40.3
Middle and Southern Atlantic	62	42	— 32.3	964	473	— 50.9
New England	65	31	— 52.3	910	507	— 44.3
Central	389	212	— 45.5	4,141	2,247	— 45.7
Total	738	370	— 49.9	8,204	4,534	— 44.7

Total Amounts Reported

New York	$20,205	$6,070	— 70.0	$196,603	$88,286	— 55.0
Middle and Southern Atlantic	4,494	3,610	— 19.7	86,911	28,136	— 67.6
New England	4,936	1,625	— 67.0	71,304	29,489	— 58.6
Central	20,234	10,674	— 47.2	293,536	130,773	— 55.4
Total	$49,869	$21,979	— 56.1	$648,354	$276,684	— 57.3

As to Rates—

• Philadelphia Electric Company's application for an injunction to prevent the Public Service Commission from enforcing its ruling that the burden of proof in a rate case rests upon the company (ELECTRICAL WORLD, August 12, page 200; September 16, page 362, and September 30, page 426) was heard again last week in the Dauphin County Court. The case is so unusual, the company through its counsel, Frank M. Hunter, told the court, in view of the fact that the new rates mean a great saving to the consumers as a whole, that the court must consider legislative intent and the public service company law in reaching a conclusion. The new rates referred to by Mr. Hunter were filed by the company, effective March 2, but S. Davis Wilson, now Philadelphia City Controller, representing some consumers, has held that the rates meant increases and not decreases. John Fox Weiss, chief counsel of the commission, also told the court that the case is unusual, as it was instituted in the middle of the rate case pending before the commission. He questioned the right of the court's jurisdiction in the matter. The argument was not concluded, but will be finished October 16. During the week the Junior Marion Lamp Manufacturing Company and the J. Schwartz Company filed with the Public Service Commission complaints charging the company rates are excessive and discriminatory.

• Union Gas & Electric Company (Cincinnati) will be subject to an immediate valuation proceeding by the Ohio Public Utilities Commission if a plea by Judge John W. Peck, counsel of the company, at a hearing before the City Council Public Utilities Committee is acted upon. When Judge Peck declared that this proceeding would prevent endless delay in both the electric and gas controversies in Cincinnati, several members of the council protested that the city already had experienced a delay of two and a half years in proceedings before the commission on the gas rate. The discussion arose over a public hearing on the new electric rate ordinance which would put into effect rates recommended by Burns & McDonnell, experts employed by the city (ELECTRICAL WORLD, June 24, page 816, and September 23, page 394). These rates are 38 per cent under existing electric rates which may be charged by the company until the new ordinance is operative. No immediate action was taken on the ordinance following the hearing.

• Columbus (Ohio) municipal plant will slash light rates in the near future to bring them in line with the new schedule of the Columbus Railway, Power & Light Company (ELECTRICAL WORLD, October 7, page 458). Mayor Worley has notified council that he is having a study made of costs and tentative rate schedules drawn up for the city plant. The city plant has been operating on a rate approximately 15 per cent below the company's schedule, but the recent reduction made in the company rates by council will bring them below the municipal plant, if the voters and the company accept them.

• Indiana Public Service Commission last week heard utility executives protest its general order abolishing penalty charges for failure to pay utility bills promptly (ELECTRICAL WORLD, September 30, page 426). Chairman McCart suggested that instead of a penalty the regular rates should be charged and a discount of 10 per cent offered for prompt payment. C. L. Harrod of the Indianapolis Power & Light Company asserted that one-tenth of the company's gross revenue now comes from the penalties and a discount would mean a loss of $500,000 annually. Mr. McCart declared that no facts were produced to justify the levy, but that he would give the utility men an opportunity to produce such facts. In the interim he would deny all "gross rates," as the 10 per cent penalty charge is known.

• Wisconsin-Michigan Power Company rates for domestic use and commercial lighting in Appleton, Neenah and the immediate vicinity have been reduced by an order of the Wisconsin Public Service Commission by an aggregate of $42,300 a year. The commission points out that its order contains two outstanding features. First, the commission creates a metropolitan area served by the company which includes roughly Appleton and Neenah and the suburban area adjoining. Second, the type of schedule prescribed is what the commission designates as a fixed or customer charge rate, a departure from the established types of rates now used by the privately owned utilities in the State of Wisconsin and not heretofore in use in Wisconsin except in instances of smaller municipalities.

• Telluride Power Company, Provo, Utah, has been asked to reduce its rates 25 per cent in a brief filed with the Public Utilities Commission by Attorney General Joseph Chez and John D. Rice, assistant. The brief contends that due to the depression the residents of the southern and southwestern Utah area served by the company are unable to meet their power bills. The case was initiated last spring (ELECTRICAL WORLD, May 6, page 568).

• California State Grange has asked the railroad commission for lower revision of electric power rates for agricultural users. Complaints have been filed against the Pacific Gas & Electric Company, Great Western Power Company, San Joaquin Light & Power Company and Southern California Edison Company. The grange asks that demand charges be eliminated entirely from the rates and that rates be fixed on the basis of a 5½ per cent return to the utilities.

• New York State Electric & Gas Corporation property, equipment, appliances and service in supplying electricity in the towns of Sand Lake, Berlin, Nassau, Stephentown, North Greenbush and Petersburg in Rensselaer County will shortly be investigated, according to an order of the Public Service Commission issued last week. The investigation was ordered by the commission on its own motion after complaint had been received alleging that the service has been unsatisfactory.

• Consolidated Gas Company electric subsidiaries, asking that the Public Service Commission vacate its order for temporary reductions of more than $8,000,000, have filed a memorandum with the commission declaring that additional operating expenses and taxes more than offset the amount of the proposed reduction. "These companies," says the memorandum, "do not now ask that existing rates be increased to cover additional operating expenses. Faced with new labor costs which will aggregate approximately $5,000,000 a year, together with rapidly increasing costs of operating materials and supplies, estimated to amount in the course of the next year to approximately $4,000,000 in excess of 1932 costs, the companies' sole request at this time is that their present rates be maintained."

▼

Kansas City Electric Show Opens

Fifty-two exhibits using every sort of electrical appliance in general use and many not yet widely adapted to everyday purposes were placed on display last week when the Electrical Progress Show opened in Kansas City, Mo. The event represents a joint observance of National Lighting week, Radio Progress week and National Electrical Refrigeration week by manufacturers, jobbers, distributors and retailers of things electrical, including electric current.

▼

Lighting Campaign in Alabama

Estimating at $558,000 the annual revenue to be obtained from the development of its potential lighting load the Alabama Power Company announces the addition of 25 employees to the new business department and intensive efforts to secure that load. Wells M. Stanley, vice-president in charge of sales, estimates that there are more than 360,000,000 kw.-hr. a year which can be sold in the existing territory served, involving an estimated annual revenue of more than $5,000,000. "We are ex-

pecting to obtain a large percentage of this new revenue from the selling of more and better lighting in homes, stores and industries served by the company," states Mr. Stanley. "The estimated first year's revenue that we have set up as a bogie is $558,800."

▼

Municipal Items

BELDING, MICH.—By a vote of 4 to 1 citizens have approved sale of the municipal plant and water rights to the Consumers Power Company.

CAPE GIRARDEAU, MO.—Special election will be held October 20 on a proposal to renew the twenty-year franchise of the Missouri Utilities Company to furnish electric light and power service. The present franchise expires in November. The City Council also has before it plans for a municipal light and power plant and distribution system to cost $685,000 (ELECTRICAL WORLD, July 15, page 73).

CINCINNATI, OHIO—Voters will ballot November 7 on the question of municipal ownership of an electric and gas plant. This decision was reached last week when petitions asking for the placing of the issue on the ballot were found to be sufficient. Should the majority of the voters favor municipal ownership, the city is mandated by the petitions to start condemnation proceedings against the Union Gas & Electric Company with the view of taking over the property.

KETCHIKAN, ALASKA—After a spirited campaign, taxpayers by a majority of 75 per cent approved a proposal for bonding the city up to $1,000,000 for purchase of electric, water and telephone utilities still operated as units of the collapsed Foshay chain. Through an act of Congress a 65 per cent majority of taxpayers is required to carry the bond issue. The same proposition failed three years ago.

EDMONTON, ALBERTA—Proposed additions to the city-owned steam power plant at Edmonton, Alberta, costing approximately $1,300,000 have been outlined in a report to the City Council by W. J. Cunningham, power, light and street railway superintendent for the city. Mr. Cunningham states that the present agreement between the city and the Calgary Power Corporation for an interchange of hydro and steam produced power terminates October 1, 1935. When this agreement expires, the city has two alternatives. By mutual agreement it could extend the interchange agreement for a further term of five years, or it could supply the demand with the city's steam plant alone. According to this report the existing plant could meet the present load demand, but would have no reserve equipment, which would be an unsatisfactory condition. To operate with the steam plant alone it would be necessary to install a new 35,000 kw. unit costing, with auxiliary equipment, about $1,300,000.

CAMDEN, N. J.—Voters at the November election will determine whether a municipally owned and operated electric light plant shall be erected at a cost not exceeding $10,000,000. The City Commissioners last week approved a referendum on the subject.

AINSWORTH, NEB.—Nebraska Supreme Court has taken under advisement, after argument, the request of the Interstate Power Company for a permanent injunction against the city (ELECTRICAL WORLD, September 30, page 427). Although arguments followed a wide range, the chief contention was over the proposition of whether Nebraska municipalities possess the right to issue debentures payable only out of future earnings, without a vote of the people, for the purpose of erecting a municipal plant.

HOMINY, OKLA.—A suit against the city, brought in Federal Court by the Oklahoma Utilities Company, has been requested dismissed before Federal Judge F. E. Kennamer, attorneys for the city of Hominy stating that the municipality did not plan to construct a municipal electric light plant. A contract with the Trans-American Construction Company for the light plant was responsible for the Oklahoma Utilities suit.

ST. LOUIS, MO.—In a resolution passed recently by the West End Business Men's Association, Inc., city officials were asked to seek a loan from the government sufficient to build a municipal hydro-electric plant to supply light for city use, residences and institutions. The petition states a municipal plant would tend to cheapen the rates of service for the general consumer and that a very low rate for power might be offered to factories and industry.

ST. CHARLES and SULLIVAN, MO.—Representatives of the Union Electric Light & Power Company of St. Louis appeared before the Missouri State Advisory Board for the Federal Emergency Public Works Administration to protest against the possible granting of loans to these cities to finance the construction of municipal light and power plants and distribution system (ELECTRICAL WORLD, July 29, page 137 and August 26, page 264). Officials of both cities upheld the applications.

▼

South Carolina Rural Survey

An independent group of South Carolina engineers has started a survey of rural electrification in the 46 counties of the state. Construction of nearly 500 miles of lines is reported possible as a result. About 100 applications for power are said to have been received since the plans for the survey were first announced. Funds for the project would be secured from the public works fund. Information is to be secured on engineering construction features, the nearest point for obtaining electricity and relationship of that point to nearby customers and highway lighting, according to Arthur Wellwood, engineer in charge. Highway lighting may be included in the projects.

▼

Los Angeles Bureau Reports

Net profit of $3,811,258 was made by the Los Angeles, Calif., Bureau of Power and Light during the fiscal year ended June 30, 1933, according to an official audit of the system just completed. The gross income for the twelve months was $14,208,769. The statement shows power bureau assets of $89,736,855 and a bonded debt of $35,216,000.

▼

Uniform Treatment of Utilities

Through full-page advertisements in local papers, Kansas City Power & Light Company has launched a drive to secure public support for equality of treatment of all utilities whether municipal or privately owned. The advertisements close with a blank coupon for readers to fill in who are in favor of tax equality, pledging themselves to vote against any candidate for public office who is known to be opposed to such a law.

▼

Associated Sues Magazine

Associated Gas & Electric Co. has brought two $100,000 suits in the Suffolk Superior Court, one against the Atlantic Monthly Co. of Boston, which edits and publishes the *Atlantic Monthly*, and the other against the Atlantic Monthly Press, Inc., which prints it, to recover for alleged libel. Plaintiff alleges libel in an article appearing in the last July issue entitled "Gas, a Study in Expansion; the Case of Associated Gas." Associated Gas & Electric sees injuries to its reputation and credit.

▼

Vancouver Municipal Balked

Hopes of the city of Vancouver, B. C., to secure municipal power from hydro-electric development in the Cheakamus River area of British Columbia received a crushing blow when engineers reported that Garibaldi Lake water escapes by subterranean seepage. The report of engineers for the Dominion Water Power and Hydrometric Bureau ruled out of the picture the most economical power site of five suggested by E. A. Cleveland, in a survey completed for the city in 1931.

Political Hygiene and Public Ownership

By ARTHUR E. MORGAN*

Chairman Tennessee Valley Authority

IN THE long run the question of public or private ownership will not be settled by theory or propaganda, but by the actual results of operation. That may seem a trite and threadbare remark. Yet if it were fully appreciated the public ownership movement would be giving more of its energies in making sure of economic effectiveness and less in promoting the extension of public ownership. In Italy the promotion of democratic and socialistic forms without the development of honest and effective administration was a chief predisposing cause of fascism.

The American people do not care very much in theory about public ownership. But for the exploitation and mismanagement by which some private utility managements betrayed the trusting confidence of the public that confidence would today be resting where it was five years ago.

For the moment public ownership on a large scale seems about to have its chance. Whether that chance will be so used as to usher in a new day in our economic life, or whether it will result in a morass of incompetence, and so bring about disgust and revulsion such as that which immediately preceded fascism in Italy, remains to be seen. Scattering cases of good management will not suffice. The public will judge by average results.

There is no assurance from on high that public ownership will bring honest and economical administration. Before national prohibition, when I questioned its advisability, I was told that "public opinion will grow up behind the law." The reverse is what actually occurred. I meet enthusiastic public ownership advocates who thrill with the conviction that the achievement of public ownership will perforce reduce public incompetence and corruption. They should take a lesson from prohibition.

I believe in public ownership of utilities and of public resources so far as it can be made to justify itself. In many men there is a quality of dignity and social mindedness which craves for expression in the public service. It is very inspiring to meet men who have given their lives to raise the level of public service, who have worked for small salaries and who get their reward in knowing that they have worked, not for personal profit, but for the public good. We need institutions which give such men a chance.

The success of public ownership will extend only so far as it can be divorced from political patronage. In the past, with public functions constituting only a small part of our social and economic life, political patronage was a vicious disease, but was not necessarily fatal. We might tolerate the Post Office Department as a patronage machine, since it was almost the only strictly business enterprise in which the federal government was engaged. If we greatly increase public ownership, then the doctrine that "to the victor belongs the spoils" will spell the doom of social and economic decency and health.

In this discussion of patronage I am expressing my own individual and personal views. I have consulted no one and have not presented these views to any public official for approval. I personally assume all responsibility for them.

As a result of observations extending over a quarter of a century, it is my opinion that the very life of the American nation is threatened by the custom of political patronage. The more widely public activities are extended, and the more government has to do with the management of our lives, the more sinister is this evil force.

Competency must supplant "pull"

If the government goes widely into business, and if the conduct of that business is to be on a high plane, then those who transact that business must be chosen because of their competence, and not because political friends have influence to get them into positions. Only rarely are people who seek positions by patronage the best fitted for those positions. Sometimes able men, under the belief that political influence is necessary in order to secure appointment, add political indorsement to direct methods of application, but they do so solely because they fear that merit unassisted by political influence is not enough.

For professional careers in the public service to become general several requirements must be met. Ability must have reasonable opportunity to express itself. Ability does not have that opportunity if the chance to serve depends on the caprice of politics and where a person is limited to his home locality in his opportunity to hold office. An able person wants to be judged by those competent in his own field. This is not possible where administrative officials are elected by general suffrage. For government to draw the best men marked ability must have opportunity for advancement in the chosen field. This usually is not the case where administrative officials are elected by popular vote and must be local residents.

Municipal managers source of federal staff

In general, the best discipline and control of any profession is the profession itself. Professional standards in medicine, law and engineering are not all they should be, but such as they are they were in general achieved by those in the professions, and not by the general public.

The managers of publicly owned utilities have it in their power to establish and to maintain professional

**From address to Public Ownership Conference, Chicago, Ill., September 30, 1933.*

standards which will, within their special field, enable them to escape from most of the evils of government I have described. This result may be brought about in the following manner:

It would be in order for a group of recognized leaders among managers of publicly owned utilities to prepare a list of those managers of publicly owned utilities who have made excellent records for effectiveness, intelligence and integrity in the public service. This list should be checked by disinterested authorities to insure its representativeness. Those men should then get together and organize themselves into an "Institute of Managers of Publicly Owned Utilities." (There would be enough genius in the group to find a more tolerable name.)

The institute should set up standards of membership that would be exacting but not arbitrary, somewhat after the manner of certified public accountants. The next step would be to develop standards of financial and administrative practice which would be prescribed for all members. If any member should be asked by his directors, or trustees, or city council, to doctor his accounts so as to make a better showing than is justified, or to make political appointments, he would have the support of the entire institute in his refusal, and his acquiescence in such a demand for dishonorable action would mean his loss of membership in the institute.

Few municipal councils or boards of directors could long withstand such authoritative condemnation. The whole level of administration of publicly owned utilities would be raised by such a policy. Another result would be that with a fair and carefully standardized system of administration and accounting one of the chief arguments of private utilities—that not all costs are included—would be taken away. Costs of similar publicly owned utilities could be compared, and thus a great incentive to increased effectiveness would be provided. The membership of the institute would be the recognized source for qualified managers, and if the manager of any publicly owned utility could not secure membership, the burden of proof would be upon him and his board of management.

One further step would complete this program. The institute should set up a central service of legal, engineering and administrative advisers who would be available to the publicly owned utilities represented by the members, at consulting rates. They might also be available to other communities needing counsel, as at rate hearings. This service should in time be self-supporting, and would fill what is now a very serious gap in public service. As every one knows, only the private utilities in general have available an adequate reservoir of legal, engineering and administrative consultants.

For several years I have hoped to be instrumental in the birth of such a comprehensive organization. One semi-selfish reason was that as president of Antioch College, with its co-operative plan, I had hoped that we might furnish a home for this consulting staff, and that our co-operative students, who spend part time at work and part time at study, might through part time work in publicly owned utilities, combined with courses in that field at college, supply a source of managers for the future. Had such an organization been under way for the past five years our problems of organization in the Tennessee Valley Authority would have been simplified.

I see no essential reason why public administration of utilities cannot be on a higher level than private administration. It may call on finer motives than are usual in private administration, and may give the people a keener interest in government by touching their everyday lives. It translates relative effectiveness into terms of rates which every one can understand.

But for these benefits to accrue, public ownership must give first attention to effectiveness of service and to ridding itself of the incubus of political patronage and the limitations of political as against professional service. If that is done, propaganda will be relatively unnecessary, for successful public ownership will be contagious.

Need Revision of Power Sales Organizations

The duties of power salesmen have expanded so that a different type of organization than formerly used is necessary, in the opinion of some utility men. As H. C. Thuerk, Utility Management Corporation, says: "Several years ago we were content to have as power salesmen individuals who were thoroughly acquainted with the costs of producing and generating steam and power in industrial and manufacturing establishments. Their job at that time was merely to shut down the existing isolated generating plants. They were power *engineers*. Today we need power *salesmen*."

Commenting on this remark, J. F. Gaskill, Philadelphia Electric Company, says: "If this is true, as I believe it to be, can we permit men who have been employed to sell to be more and more burdened with the troubles and problems which develop on loads sold by them in years gone by? It appears obvious to me that some sort of split-duty organization is indicated, *i.e.*, one group to sell, another to handle existing customers' problems (engineering, billing and complaints, etc.) and another to handle office routine and records. This type of organization provides the best possible kind of training ground for salesmen in that division of the department, which relieves the salesman of the work with existing customers. In this work the young man will gain knowledge of the territory, customers' problems, the tariff, plant operation and the extraordinary facility with which human beings can convince themselves that what they want is right.

"No matter how the work is split to relieve the salesmen, the set-up should have the following features:

1. Flexibility. In order that any phase of the market may be attacked at any time with the entire sales group.
   This gives the personnel variety of work and a minimum of friction in handling.
2. Complete coverage of existing customers by a group outside the sales force.
   This frees the salesman's mind of details of billing, complaint and engineering analysis. He knows that, when needed, he will be called in on the job.
3. Accuracy and uniformity in the routine and record work of the department.
   This avoids friction with other departments and with customers.
4. Continuous search for and analyses of new applications.
   This stimulates confidence and enthusiasm as the market horizon widens.
5. The possibility for a man to work up through the organization.
   This assures the man that he can progress.
6. Adequate remuneration, graded up to the salesmen as the most responsible men below the supervisory group.
   This is the only way in which a man can measure the appreciation and understanding of his efforts and difficulties.

"Combined, these features are the foundation of teamwork and good morale, without which nothing can be done. We must not forget that good men will give, willingly, that seemingly impossible extra 50 per cent of effort if the machine of which they are a part gives them confidence in its effectiveness, arouses their pride in the way in which it operates, gives them hope for the future and assurance of fair reward for effort in the present."

Methods Used to Select Commercial Lighting Fixtures

By KARL STALEY*

Illuminating Engineer, Incandescent Lamp Department, General Electric Company

CENTRAL-STATION engineers have the advantage of being in a key position to guide the purchase of large numbers of fixtures for industrial and commercial customers. There are times, however, when the large customer believes that a test of competitive equipment on his own premises is necessary. In this connection the procedure used recently in selecting lighting fixtures for a number of buildings in New York City has been sufficiently outstanding that a more general exploitation of the methods seems deserved.

Equipment manufacturers have voiced the opinion that tests of this type are fair to all, and while they cannot take in or keep out everything, they represent an engineered opinion rather than multiplication of personal preferences and prices and personalities. They provide a superior means to that often encountered when a purchaser finds himself confronted with a dozen catalogs and but scant knowledge to guide him.

A notable example of such an illumination study is one that was used in selecting commercial lighting fixtures for a certain class of operating room of the Western Union Telegraph Company. The procedure followed in one case is outlined and is typical of the method employed in practically all applications. While for obvious reasons the results given in the tables are fictitious, they may be considered as actual results, since they do not affect the method, scope or intent of the study.

In this particular study twelve leading manufacturers were consulted with regard to the requirements and asked to submit samples of lighting fixtures for use in operating rooms. Fourteen sample fixtures from seven companies were selected for preliminary tests and inspections. From these tests and inspections it was seen that the products of only four of the manufacturers approximated the type of fixture which was desired. These manufacturers were asked to submit, at prearranged dates, groups of 30 fixtures for extensive tests and inspections under actual operating conditions which would meet or approach the following requirements:

1. Fixture to be designed for a 300-watt lamp.
2. Minimum glass diameter of 16 in.
3. Maximum globe brightness of 1.5 cp. per square inch at all angles between the horizontal and a zone 15 deg. from the vertical axis.
4. Submit candlepower distribution curve with data as to light flux, brightness, over-all efficiency, etc., similar to the form prepared by the Electrical Testing Laboratories.

The fixtures submitted by these manufacturers were tested and inspected for average lighting levels in foot-candles on the working plane, glare, maintenance, appearance, safety and type of construction of globe and hanger. These characteristics were rated in conjunction with the unit bid prices on the basis of 100 per cent for the best as shown in Table I. The type of glass and the design of the hanger were not separately rated, but were included in the ratings of brightness of globe including glare, maintenance, appearance and safety. The ratings were then weighted or loaded according to their importance, giving the results in Table II

In arriving at the results which placed fixtures "A," "B," "C" and "D" in the relative order, it was necessary to conduct a careful test and inspection of the units and to determine relative ratings for each. A section of a telegraph operating room therefore was rewired to accommodate thirty fixtures under the same conditions as contemplated in the proposed new office. Each group of fixtures was installed, tested and observed for a period of six weeks. At the conclusion of the tests about one-fourth of each group of fixtures were reinstalled and observed collectively for about three months.

Nature of tests

In deriving the relative percentage ratings the following characteristics of the fixtures were considered:

Brightness of Globe Including Glare—In considering this characteristic fixtures having a surface brightness of 1.5 cp. per square inch or slightly less were regarded as satisfactory for Western Union operating rooms. The fixture whose globe brightness approached nearest to this value attained the best rating. The other globes were rated accordingly. The brightness of the globe was obtained from the Electrical Testing Laboratories' data furnished by the various manufacturers. However, special brightness tests were conducted and the lighted appearance of the globes and bowls carefully observed by a group of engineers, and their observations included in conjunction

Table I—Unloaded Rating of Fixtures Compared

(Illumination Studies—W. U. T. Co.)

Fixture	Foot-Candles on Working Plane	Brightness of Globe	Maintenance	Safety	Appearance	Price
A	80	81	85	100	92	80
B	55	95	67	73	83	85
C	100	60	55	83	68	100
D	55	48	100	88	100	75

Table II—Weighted or Loaded Ratings of Fixtures

Fixture Loading	Foot-Candles on Working Plane Per Cent	Brightness of Globe Per Cent	Maintenance Per Cent	Safety Per Cent	Appearance Per Cent	Price Per Cent	Total Per Cent
	25	40	12	8	5	10	100
A	20.0	32.4	10.2	8.0	4.6	8.0	83.2
B	13.7	38.0	8.1	5.9	4.1	8.5	78.3
C	25.0	24.0	6.6	6.5	3.4	10.0	75.5
D	13.7	19.4	12.0	7.0	5.0	7.5	64.6

*Presented before Lighting Service Conference, Delavan, Wis.

Table III—Chain Store Illumination Comparisons

Factor	Per Cent Weight	Fixtures A	B	C	D	E
Horizontal illumination	35	35.0	30.5	31.6	33.5	33.3
Average illumination during life	25	23.3	21.4	23.3	23.3	25.0
Maintenance cost	16	15.0	16.0	15.0	15.0	16.0
Appearance	9	.5	8.0	9.0	8.5	7.0
Price	15	7.8	15.0	6.6	7.4	3.1
Totals	100	88.6	90.9	85.5	87.7	84.4
Place	....	2	1	4	3	5

with the brightness data collected for rating this characteristic of the fixtures.

Lighting Output on Working Plane—The lighting output on the working plane was measured with a Macbeth illuminometer. Foot-candle readings were taken on the receiving and sending positions at the operating tables. The average intensities were used in the comparison of the light output on the working plane.

Maintenance—Surface and finish of the glass, type of unit open or inclosed and design of the holder were factors in determining the maintenance requirements. The unit which incorporated the best features for maintenance was given a rating of 100 per cent.

Price—The unit price of these fixtures as submitted by the manufacturers in their bids on furnishing the fixtures for the building were used in rating the units for this factor. The fixture which was lowest in price was given a rating of 100 per cent and the others rated accordingly.

Appearance—Appearance of the fixtures was determined by the consensus of opinion of a number of observers considering the design of the globe, holder and canopy, type and finish of glass and the lighted and unlighted effect of the globe. The most pleasing fixture was given a rating of 100 per cent.

Safety—The fixture whose design was such that it presented the minimum hazard to the personal safety of employees and to the continuity of telegraph service was given the highest rating.

General—The fixtures which received a relative rating as low as 75 per cent but above 65 per cent on any one of the above characteristics were considered somewhat undesirable, while those whose rating on any one qualification fell to 65 per cent or less were eliminated from consideration. However, these fixtures were rated so that they could be reconsidered whenever the serious defects were corrected.

The final loaded percentages were calculated by applying the following weighting or loading factors:

	Per Cent
Glare	40
Foot-candles on working plane	25
Maintenance	12
Price	10
Safety	8
Appearance	5
Total	100

These loadings have been carefully determined for a certain class of telegraph operating room, but would not necessarily apply to any other lighting problem.

A test somewhat similar in character was conducted by a chain store organization for determining a choice of indirect lighting unit for general office space. Table III indicates the ratings after their respective weighting factors were applied. The factor "Price" was considered to be the original cost plus any charges for lamp silvering over a period of years. Horizontal illumination was read on spacings 1½ per bay and six similar readings were made in an installation of four per bay. "Average Illumination During Life" was taken under the existing maintenance conditions, as 65 per cent for mirrored glass units, 60 per cent for porcelain enamel steel and 75 per cent for others.

A large publishing company was recently confronted with the problem of selecting fixtures for offices and set about to install fixtures in typical bays in the unfinished portions of the building. Four direct, seven semi-indirect and five indirect units were tested and the results were interesting in that they divulged numerically the characteristics of each type. The form used was similar to the plans previously given and for many purposes it was ideal. Of particular note is the fact that illumination was weighted at 73 per cent, operation 19 per cent and the remaining 9 per cent was credited to cost.

Sheets were made up listing the sixteen fixtures to be examined by name and the fixtures were tagged for easy identification. Each man of a group of engineers and officials was asked to grade the units in terms of per cent. The judges inspected the fixtures lighted and unlighted in typical bays. The ratings were added and averaged. The figures were then combined with the principal tabulation as shown in Table IV.

For obtaining ratings on system efficiency, candlepower maintenance, and distribution, four samples of each unit were installed in a typical bay. Measurements were taken at point (a), under one fixture; at point (b), at the center of the bay; at point (c), between two fixtures, and point (d), at the center between two pillars at the outer edge of the bay.

The distribution ratings were made according to the following: If (b) was equal to or greater than 80 per cent of the maximum the fixture was rated at 90.

If (c) was less than 80 per cent of the maximum the fixture was rated at 80.

If (d) was less than 55 per cent of the maximum the rating was reduced 10 per cent more. The factor, system efficiency, was taken as an average of the sum of a, b, c and d for each unit.

The unit with the greatest light output from these averages was rated 99 per cent and all the other fixtures were scaled accordingly.

For candlepower maintenance inclosed units were given a rating of 93 per cent. When the inclosed type of unit had other appurtenances, such as replaceable caps or other devices, they were rated 90 per cent. Open-

Table IV—Office Lighting Fixture Ratings

Fixture	Factors and Weights	Illumination — 73 Per Cent: Glare 39	System Efficiency 24	Candlepower Mtce. 7	Distribution 3	Operation — 19 Per Cent: Workmanship 2	Mechanical Features 2	Ease of Maintenance 11	Aesthetic Appearance 4	Cost 8	Totals	Place
A..... Typical direct.....	Average	63.3	89.5	93.0	80.0	82.0	78.4	84.1	84.1	100.0	...	..
	Weighted average	24.7	21.5	6.5	2.4	1.6	1.6	9.2	3.4	8.0	78.9	7
B..... Typ. semi-indirect...	Average	77.3	62.5	90.0	90.0	81.0	57.0	58.6	58.6	64.2	....	..
	Weighted average	30.2	15.0	6.3	2.7	1.6	1.1	6.4	2.3	5.1	70.7	15
C..... Typical indirect.....	Average	94.7	75.0	80.0	90.0	86.0	84.6	75.8	75.8	41.3	....	..
	Weighted average	36.9	18.0	5.6	2.7	1.7	1.7	8.3	3.0	3.3	81.2	2

Table V—Characteristics of Indirect Luminaires

Luminaire	Light Output of Equipment Per Cent Initial Lumens 0-90 deg.	0-180 deg.	Angle of Cut-Off Degrees	Brightness of Bowl (G) Cp. Per Square Inch	Filament Image Visible 2½ Ft. Below Top of Bowl At 20 Ft.	At 50 Ft.	Streaks, Striations, or Shadows on Ceiling
A	11.5	**90.0**	97.	0.8	Yes	Yes	Yes
B	6.0	88.5	97.	0.2	Yes	Yes	No
C	0.0	80.5	100.	0.004	Yes	Yes	Yes
D	0.0	72.0	110.	0.002	No	No	Yes
E	0.0	*70.0*	103.	0.004	No	No	Yes
F	0.0	75.5	106.	0.004	No	No	Yes
G	0.0	*70.0*	103.	0.0004	No	Yes	No
H	7.0	73.5	97.	**1.5**	No	No	No

Table VI—Illumination Data

Considering Room to be 2x4 Bays

Luminaire	Considering Lighted Bay Only. Foot-Candles	Initial Average. Foot-Candles	Average Lumens in Per Cent Initial	Average Depreciation Due to Dust and Dirt	Average Foot-Candles in Service
A	16.1	27.1	87	10	**21.2**
B	15.5	26.1	87	10	20.4
C	13.6	23.7	87	10	18.5
D	13.1	22.6	87	10	17.7
E	12.8	21.9	87	10	17.2
F	13.8	23.0	87	10	18.0
G	12.3	20.8	87	10	*16.3*
H	13.1	22.4	87	10	18.1

Table VII—Cost Analysis of Different Indirect Luminaires

Luminaire	Fixed Costs Per Fixture Per Year: Reflector Prices	Interest and Depreciation 15 Per Cent of Net Fixture Cost	Cleaning	Other Costs, Per 1,000 Burning Hours: Power at 3 Cents Per Kw.-Hr.	Lamps 20 Per Cent Off List
A	$11.00	$1.65	$0.60	$6.00	$0.64
B	8.00	1.20	0.60	6.00	0.64
C	10.56	1.58	0.60	6.00	0.64
D	6.72	1.01	0.60	6.00	0.64
E	*4.65*	.70	0.60	6.00	0.64
F	13.16	1.97	0.60	6.00	0.64
G	6.29	.94	0.60	6.00	0.64
H	**17.89**	2.68	0.60	6.00	0.64

Table VIII—Relative Light per Dollar with Indirect Luminaires

Luminaire	1,000 Hours: Annual Operating Cost Per Fixture	Relative Foot-Candles Per $1.00, Per Cent	2,000 Hours: Annual Operating Cost Per Fixture	Relative Foot-Candles Per $1.00, Per Cent	3,000 Hours: Annual perating Cost Per Fixture	Relative Foot-Candles Per $1.00, Per Cent
A	$8.89	98.5	$15.53	100.0	$22.17	100.0
B	8.44	100.0	15.08	99.0	21.72	98.2
C	8.82	86.7	15.46	87.6	22.10	87.5
D	8.25	88.7	14.89	87.0	21.53	86 0
E	*7.94*	89.5	*14.58*	86.3	*21.22*	84.7
F	9.21	80.8	15.85	83.0	22.49	83.6
G	8.18	82.3	14.82	80.5	21.46	79.3
H	**9.92**	75.5	**16.56**	80.0	**23.20**	81.5

bowl units were rated at 80 per cent in this column and open-bowl units with a questionable finish were given a rating of 70 per cent.

The cost column was determined as follows: The cheapest fixture received 100 per cent and all the others scaled accordingly. If a fixture was twice as costly as the cheapest, it was given a rating of 50 per cent. When it was necessary to provide additional equipment, such as silvering on lamps, throughout the life of a fixture, there was added the cost of a selected number into the total cost of the unit.

In order to arrive at the weighted averages all that was necessary was to multiply the average figures thus obtained by the weights as shown just below the factor titles. Hence, if a fixture were rated at 50 per cent of cost it received four points in this column. Then the total weighted average units were added and the determination of the place was found.

A light and power company recently conducted a test of 37 different lighting units representing the products of nineteen different manufacturers. Preliminary examination narrowed the field to sixteen different lighting units. The factors considered in the test and their weight are as follows:

Factor	Points
1. Illumination	15
2. Glare (excessive brightness)	35
3. Distribution	15
4. General light quality	15
5. Maintenance	12
6. Appearance	8
Per cent	100

For the illumination readings, twelve fixtures of each make were hung in the test area. These comprised four units on symmetrical spacing within the bay and two units in each direction outside the bay. Readings were taken at (a) the center of the bay; (b) directly beneath one fixture; (c) between two units on the short dimension; (d) at the center of four outside units, and (e) at the near corner of one pillar.

An ingenious method of quickly installing and removing the fixtures was developed. The unusual amount of handling of fixtures brought out a number of points on quality and workmanship not otherwise discernible.

Comparative data on indirect luminaires from tests conducted by the Electrical Testing Laboratories was recently compiled by an electrical manufacturer. As a method of analyzing lighting equipment, it goes into the cost of light probably more thoroughly than would be usual for the average customer, but it presents perhaps more significantly a true picture of the dollar value of a lighting fixture.

These data have been divided into four parts. The first is a study of the characteristics of the luminaire. The readings were taken from photometric curves and other data. It is significant to note in the second column of Table V a range of output values of 70 to 90 per cent However, high output values are accompanied by high brightness values and bad streaks and striations or shadows on the ceiling. When the cut-off is above 100 deg. there is a marked improvement in results from the standpoint of glare.

In Table VI these data compare results in average light obtained under service conditions. It is of interest to note that the prices in Table VII vary three to one and the lighting results in Table VI show about 30 per cent variation.

The third table in this group (Table VII) outlines the fixed and other costs. These would cover probably a great latitude in different parts of the country and the charges such as for cleaning would vary widely for individual customers.

The analysis of the last chart (Table VIII) has been brought down to the relative foot-candles per dollar for 1,000 hours, 2,000 hours and 3,000 hours operation per year. In the final rating no factors are applied as to appearance of lighting equipment, appearance of lighted ceiling, or glare. However, these factors are identified so that one could take these into consideration.

Modernization in Manufacture at Cleveland Tractor Company

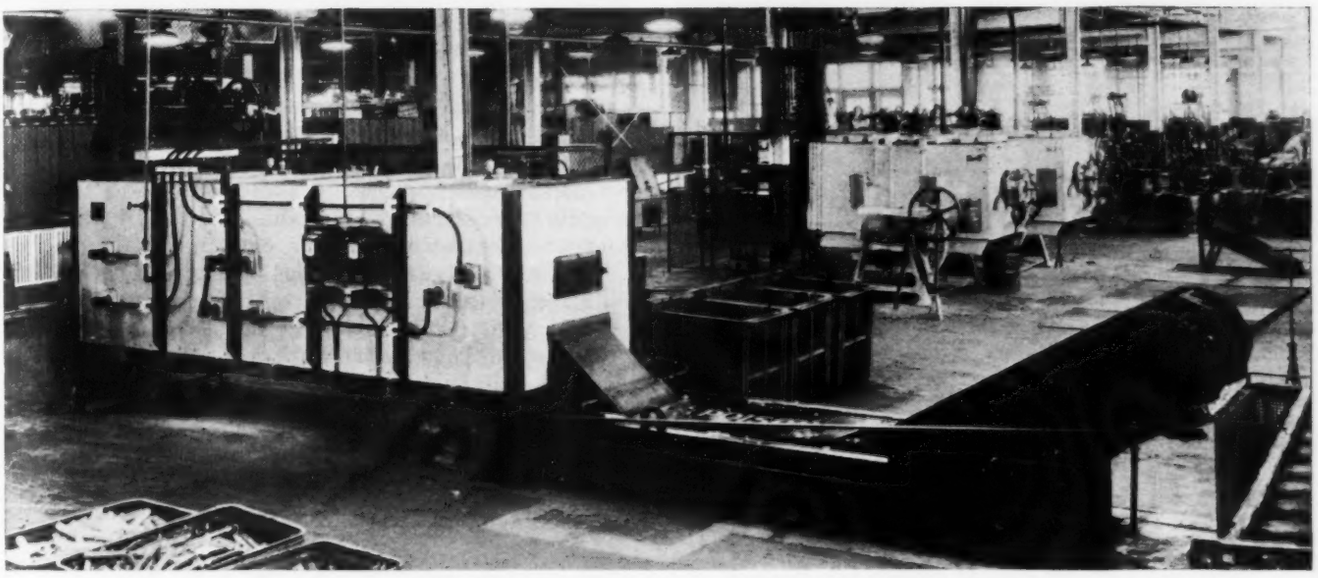


Fig. 1—Pusher furnace hardens pins, bushings and rollers for truck assembly, after carburizing in the furnaces seen in the background

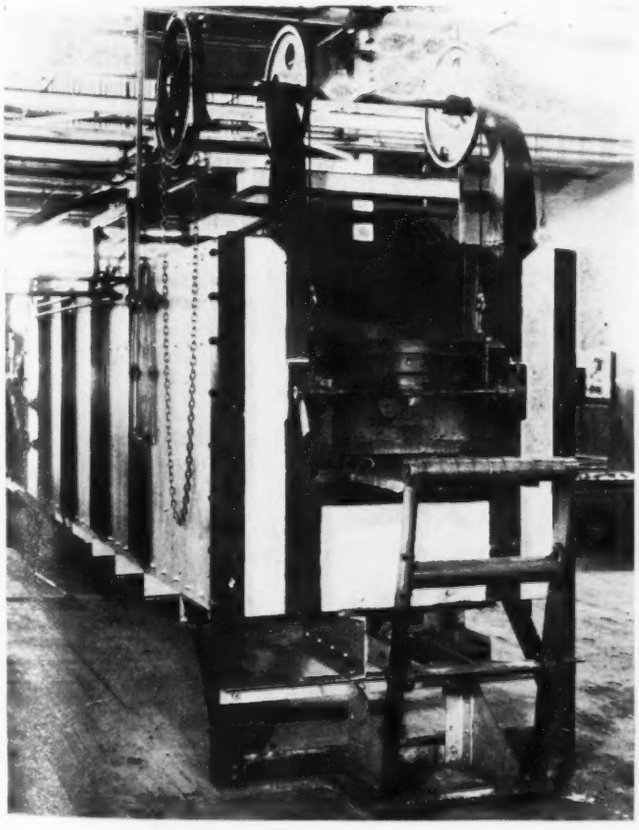


Fig. 2—Charging end of 100-kva. pusher type furnace

TYPICAL of the application industrially of electricity to obtain modernization in manufacturing processes is the installation of electric ovens throughout the Cleveland plant of the Cleveland Tractor Company. Despite the recent years of financial stress, this company has invested large sums in installing electric furnaces and rearranging production lines for greater efficiencies and manufacturing economies.

Heat treatment plays an important part in the manufacture of tractors and tractor parts. The importance of this phase of plant activity can be better appreciated when it is known that in one Cletrac model alone there are more than 5,800 lb. of heat-treated parts.

The heat treating is done largely with electric furnaces. But whereas in most plants heat treating is made a separate department with parts sent in for treatment and when finished carried back to a regular production line, at the Cleveland Tractor Company the heat-treating department has been eliminated and individual furnaces placed, so far as possible, directly in the various assembly lines.

At present no furnace does two jobs. Each is so set up and adjusted that it handles one type of part, and one only, at that point in the production line where heat treatment is necessary.

While there are many electric heat-treating furnaces in the production lines throughout the plant, certain units stand out as being especially interesting. Carburized rollers and bushings for the tractor track shoe assemblies are carried to an electric furnace of the pusher type, operating at 100 kva. As the parts are pushed into this furnace automatically on a V-groove hearth they are hardened in temperatures ranging from 1,380 to 1,435 deg. F., depending upon the parts being treated. The

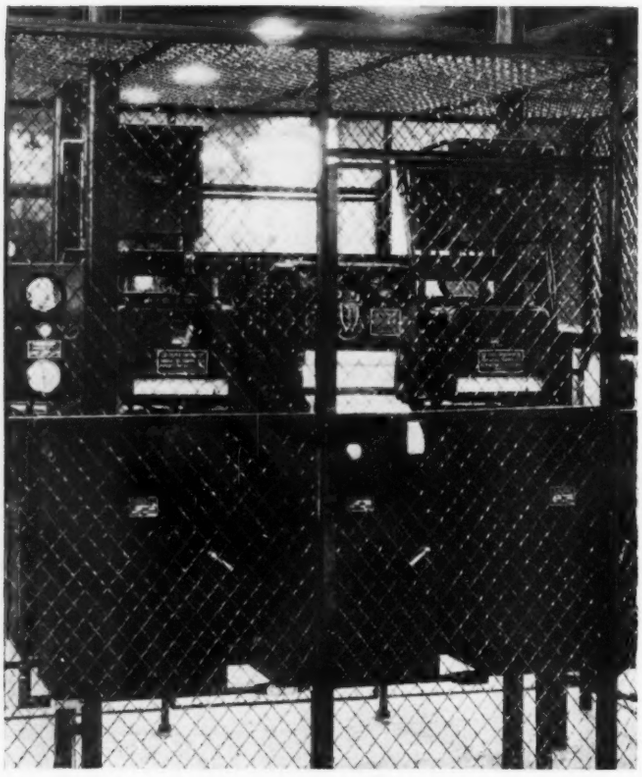


Fig. 3—Leeds & Northrup temperature control instruments are used on electric carburizing furnaces

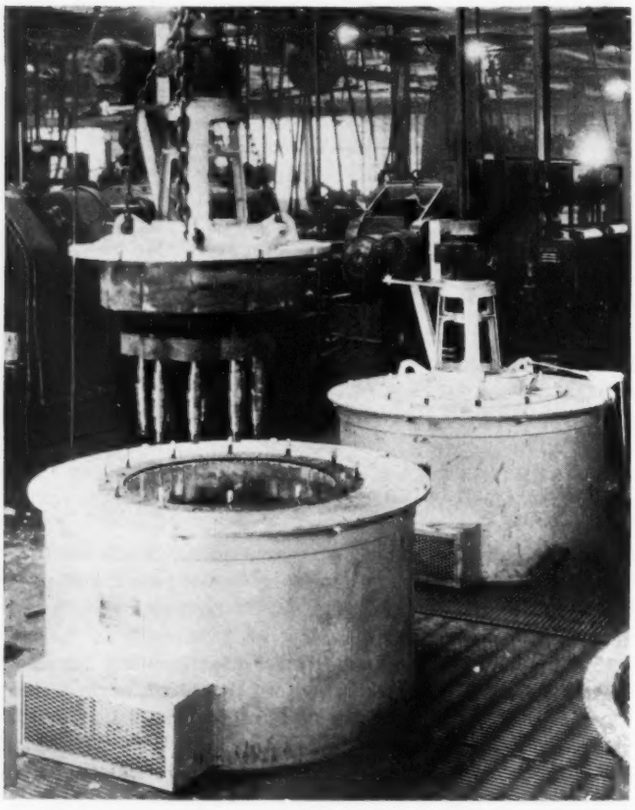


Fig. 4—Rotary electric furnaces permit suspension vertically of shafts to be heat treated and eliminate warping

furnace, divided into two heating zones, has a capacity of 800 lb. of parts per hour, and is operated under full automatic control. As parts come from this furnace they are discharged through a covered chute into a caustic soda-quenching bath kept constantly agitated. After rinsing they are again delivered to the assembly line.

In the gear and shaft department parts are hardened in a 100-kva. electric furnace having a conveyor hearth system. The capacity of this furnace is 800 lb. of parts per hour. Temperatures here vary from 1,350 to 1,550 deg. F.

Shafts used in a lower track wheel assembly are heat treated adjacent to the final assembly line where they are used. This work is done by two circular pit-type rotary electric furnaces, where a temperature of 1,480 deg. is automatically maintained by means of a Leeds & Northrup potentiometer recording controller. The first of these furnaces contains a revolving spider with ten holes, from which are suspended the smaller size shafts; the second furnace contains a spider having seven holes for holding the larger-sized shafts. During the 20 to 40 minutes required for the former furnace spider to make a single revolution the parts are completely heat treated and ready for quenching. The capacity of each spider furnace is 160 lb. of shafts per hour, using 35 kva. apiece. Shafts so suspended during the heat-treating operation come out without the slightest warping, and consequently eliminate the expense of a subsequent straightening operation.

▼

Need Specific Approach to Market

The immediate approach to the development of new markets is to find specific applications for service in existing customers' plants. It is no longer enough to measure his needs in terms of broad generalities, such as electric heating, air conditioning, industrial development, industrial lighting, etc. Many of the applications which we will find will not fall in these broad generality classes.

Viewed in this way, new surveys of existing customers may reveal possible applications that were formerly overlooked in the more general approach to securing new business. For example, F. M. McQuillan, power sales manager, West Penn Power, points out that although the brick industry has often been considered to be highly electrified, yet a survey reveals that there is a very large market for further electrification. It shows, he reports, that of the total possible connected load 65 per cent is not now being served electrically. Of this amount 26½ per cent includes engines for part or all of the plant drives; 22½ per cent covers uses for electricity which have proved successful in some plants, but in general are not accepted in the industry; 31 per cent is material-handling equipment which could be used successfully; 3½ per cent is additional ventilating equipment which would enable the user to more quickly empty his kilns; 9½ per cent is electric heating load; 7 per cent is industrial lighting. Some of the load included in these percentages, he continues, needs still further study before we will be ready to sell it. However, the applications have been tried and proved successful.

Foundrymen Indict Industrial Rates

"WITHOUT doubt, many owners of industrial businesses have wondered why power costs should advance 50 to 200 per cent, or more, per kilowatt-hour during the time industry must reduce prices on account of poor business conditions. Practically all materials and commodities purchased by industry during slack times are bought at reduced prices, but not so with power."

Evidently power salesmen have not convinced power customers that the very elementary commercial proposition of low unit costs for large quantities applies also in reverse as higher unit costs for reduced quantities.

"Unfortunately, there has been no attempt to standardize rate contracts throughout the country, nor has there been much attempt made to simplify the types of contracts. *In many instances rates and contracts have been made as complicated as possible, so as to make it difficult to understand or compare rates of one locality with another.* Such practice on the part of the utility company is to be condemned, and eventually the utility company will lose the confidence of the customers served."

This same question of non-uniformity of rate forms has been raised by pipe line companies, packers, railroads and other customers whose operations require service from a number of electric utilities. Difficulties of such customers in accounting and in making cost comparisons between operations in different geographical regions and the slowness of the utilities to remedy the condition, or even to recognize it as serious, are to be deplored. Utility men know that the reason for complications of rates and for differences between them lies in the inability of rate experts and near experts to reconcile detail divergences in individual rate philosophies. Some customers manifestly find it easy to believe that rate complications and differences are a deliberate device for obfuscation.

Not adjusted to customer's viewpoint

From general observation it is apparent that many utility companies are not very familiar with the problems of their industrial customers, nor have many of them shown much inclination to want to learn these problems. Too many times utility rate structures are developed along the lines to get all the revenue that the traffic will bear, and in addition terms and conditions are imposed under which the customer cannot operate his plant just as it should be operated without inflicting penalties on his operations that are very costly.

"A few utility companies have recognized the problems of their industrial and foundry customers and have earnestly endeavored to reduce rates and withdraw unreasonable restrictions, so that in some localities electric furnace operators have been able to continue to handle what little business there has been available without severe rate penalties."

Another slap with a pat on the back following it. The pat on the back is well deserved and the slap cannot be taken as a reflection on the individual competence of the power salesman in his job. It is a reflection, rather, on too-frequently-encountered management that keeps power sales departments understaffed and will not believe that the signed contract is only the beginning of power selling.

Representatives of the Steel Founders Society, Grey Iron Institute and Malleable Iron Research Institute joined together in a Power Conference Committee and met to discuss "Electric Power Costs in the Foundry" the day before the American Foundrymen's Association opened its convention in Chicago. The committee started its discussion with a paper read by James R. Allan, from which the quotations in this article are taken to show the need for "more light on power rates."

The indictment has twelve counts

Twelve counts are contained in the indictment brought against the electric utilities by the foundrymen. Here they are, in somewhat abbreviated form:

1. *Demand Charges*—Demand charges should be adjusted monthly on the basis of operating demand in kilowatts. Demand charges must not be applied against connected load, which is unfair because such a method does not represent the actual use. Industrial customers are further urged to insist that their utility companies rearrange their rate schedules, so that the operating demand is determined in kilowatts rather than kilovolt-amperes or horsepower.

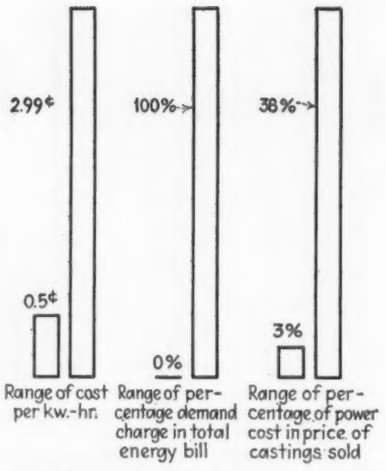
2. *Method of Determining Demand*—Many utility companies exact a too-severe penalty in determining the maximum demand and do not give sufficient credit for their own diversity factor. Demands determined on the basis of a single five-, ten- or fifteen-minute interval or multiples thereof are very unjust to the customer.

3. *Ratio of Demand Charges to Annual Charges*—Much of industry has just been going through the experience of paying utility bills, in which demand charges constituted by far the larger part of the bill. If the demand charges per kilowatt are reasonable and based on the proper valution of the utilities' properties they will not constitute as great a portion of the total bill.

4. *Off-Peak and Unlimited Service*—Many utility companies have instituted the practice of applying off-peak and unlimited types of service. If a utility company has several types of service the on-peak and off-peak hours should be reasonable. It happens, too, many times that utility companies impose certain restrictions, which are believed in many instances to be unjustified, forcing industries to operate at unnatural and unreasonable hours.

5. *Minimum Bill*—The committee feels that it is unfair for any utility company to impose a minimum bill based on the highest kilowatt demand in the previous eleven months. The annual demand type of contract has got to go out of the picture if industry is to be satisfied. In the event that a plant has to shut down through lack of production, we strongly recommend that minimum charges be dropped, but that the life of the contract be extended the number of months that a plant is not operating.

6. *Power-Factor Clauses*—Some utility companies' applications of power-factor clauses in contracts are unfair to industrial customers. A great many customers have installed corrective apparatus at considerable expense to improve the power-factor conditions of their plants. Yet, in many instances, the utility companies will give no credit for good power-factor earned, and will penalize the customer for poor power-factor at too high



These graphs show minimum and maximum values set forth in a tabulation of power costs in foundries presented by the Power Conference Committee of associated foundry groups. The tabulation lists 129 replies to questionnaires from 38 states. It shows that power costs for foundries are in general lower in the South and West and are higher in the industrial regions in the North and East.

Why the foundrymen complain

a rate, and it is believed that credit or penalty should be based on a 70 or 75 per cent lagging power-factor.

7. *Coal Clauses*—The industrial customer should make sure that the coal clause is based on a fair market price for coal.

8. *Term of Contract*—Many utility companies have the practice of requiring that the customer sign up for a period of five or ten years. Such types of contracts should be absolutely avoided and customers should lean toward contracts of relatively short duration—one, two or three years, with 30- or 60-day notification clauses by either party at the expiration time of the contract term.

9. *Parallel Operation*—All contract forms should permit the customer to operate his own existing equipment, or equipment that he may put in at a later date, in parallel with the utility service.

10. *Combination of Service*—Industrial customers should insist that rates and contract forms be worked out by the utility company, so that the customer obtains all of his power through one meter for any combination of operations, such as electric melting, machine shop load, factory lighting, etc., rather than having separate contracts for each specific use of power.

11. *Transformers*—Some utility companies have the practice of supplying the transformers for stepping down the primary current to the secondary current, which is the normal voltage used in the factory. In other instances the customer must supply the necessary step-down transformers. Either way is satisfactory, providing the rate structures take care of the situation. It is believed, however, that it is better practice for the customer to own the transformers, because this helps to reduce the utility company's capitalization.

12. *Discounts*—There are many ways of applying discounts for prompt payment, and some general standard practice should be adopted. It is recommended that a percentage discount be applied either on the total bill or on the energy charge.

The distinct indication of these counts is that at least the men who drew them up have little faith in the fairness of rate policies. More than that, one item, No. 7, comes close to an admonition to the customer to watch out for dishonesty. It is the height of folly for any utility executive to imagine that these strictures do not apply to his company, that *his* power customers do not have any such murmurs as these. Even though his customers may not have these feelings now, they are sooner or later likely to be infected by them unless intense and vigorous effort is made to anticipate them by education.

▼ ▼ ▼

Indirect Portable Increases Home Revenue

By D. W. ATWATER*
Westinghouse Lamp Company

Right now there is a domestic lighting unit—the indirect portable—which offers tremendous possibilities as a load builder. Its popularity owes its start perhaps to the overwhelming popularity of bridge—a parlor game which adverse business conditions have helped to promote. Though the ideal lighting unit for bridge, the indirect portable has a host of other uses in the home, especially where a good source of general illumination is desired instantaneously and at any position in the room.

It is conservatively estimated that the indirect portable provides an annual load of 165 kw.-hr., based on the assumption that it will be used on an average of 1½ hours per day. This estimate may seem low, but allowance is made for summer months when burning hours are short and also for the fact that indirect portables are, to some effect, a replacement load. Availability, however, of better lighting generally develops increased usage and results in higher intensities in other rooms.

In the indirect portable we have an appliance which consumes kilowatt-hours equivalent to one-fourth of the entire load in the average home. It is inexpensive (about $12), but attractive for the amount of annual revenue it produces (about $9.90). On top of that, it has a potential market of 90 per cent of the twenty million and more wired homes. Experience proves it can be sold.

Many housewives, when told that an indirect portable uses a 300-watt lamp, will throw up their hands in alarm, having an exaggerated idea of current cost. They little realize that it can be used for only a few cents an hour. This constitutes one idea the utilities have to sell in order to surmount such sales resistance.

Other customers may complain that indirect illumination destroys the decorative effect of a room. A luminous shade surrounding and concealing the reflector will eliminate this objection.

Another method of attack on this sales front is, show the user how much better the lighting is from this type of unit and how thus it will safeguard the eyes in activities about the home. Vision is our most precious asset, judging from the fact that of all the mental impressions the human mind receives, some 87 per cent pass through the eye. Impressing the value of adequate illumination for children studying will be most helpful in putting over the idea of indirect portables.

A study of various types of equipment now available and experiments with laboratory samples indicate that the following principles will insure the most satisfactory results from indirect portable equipment: (1) Over-all efficiency should be at least 80 per cent.; (2) at least 10 ft.-candles should be provided immediately adjacent to the unit; (3) a downward direct component of light is necessary—it permits greater variety of application and encourages popular use; (4) reflectors should be of translucent material; (5) decorative shades hide the reflector and blend more harmoniously with room furnishings; (6) reflectors with wide openings trap less light and insure better efficiency.

**Excerpts from paper presented at Lighting Service Conference, Delavan, Wis.*

Trends in Turbine Engineering

By C. RICHARD SODERBERG*
Manager Turbine Apparatus Division,
Westinghouse Electric & Manufacturing Company

THE drive toward improved economy of our power stations is as intensive as ever, but there is a growing conviction that fixed charges play a rôle in the cost of electric power which is threatening to be dominating. This problem must be solved, not by cheaper and less efficient machinery, but by advances in efficiency which are obtained without appreciable increases in cost. In addition, there must be no compromise on reliability.

Assume that the cost of power is made up of two parts—the *load part,* inversely proportional to over-all efficiency, and the *fixed part,* directly proportional to cost of installation. The accompanying table then gives equivalent cost of installation for different over-all efficiencies and for different ratios of load part to capital part. If the load part and the fixed part stand in the ratio of 40 to 60 at 28 per cent efficiency, a gain in over-all efficiency from 28 to 40 per cent (43 per cent reduction in heat consumption) must not add more than 17 per cent to the cost of the installation in order to be justifiable from an economical point of view. It is safe to state that it must be considerably less than 17 per cent in order to make the venture sufficiently attractive.

This situation has injected a certain amount of hesitation in the advance toward higher pressures, at least as far as our own country is concerned. However, they must be used if efficiencies in excess of 30 per cent are to be realized, so that the question of reheat cannot be evaded. (Conditions vary, of course, with arrangement for reheat, etc., but it is generally necessary to consider reheating for pressures in excess of 750 lb./in.^{2}.) The available information is insufficient to decide whether or not this solution will result in lower cost of power. It seems safe to conclude that with conventional water-tube boilers the gain in going to pressures requiring even one stage of reheating is questionable.

There are boiler developments in the embryo stage, however, which may upset this condition entirely. The forced circulation type of boiler, without drums, has advanced very rapidly in Europe during the last few years. With this type of boiler it is well within the realm of possibilities to so design the entire power generation plant unit that the principal objections to reheating are eliminated. This would raise the practical operating pressures to the critical pressure (3,200 lb./in.^{2}) and above.

Development of such a fundamental nature can only come slowly, however. In the meantime the industry is endeavoring to solve its problems in the best possible manner, using equipment which does not go too far beyond the conventional.

The most direct solution is to raise the inlet temperature. A limit is soon reached in this respect, however, because of the inherent limitations of our materials and the intricate nature of the steam turbine as a piece of mechanical equipment. At the present time there are a large number of turbines in operation using 825–850 deg. F. inlet steam. It is somewhat too early to establish whether or not the resulting increase in maintenance expense is temporary or permanent; a certain increase must, at any rate, be accepted. Inlet temperatures up to 1,000 deg. F. can be regarded as possible, but it is too early to say whether such temperatures are generally practicable or not.

The super-position of high-pressure equipment on existing low-pressure turbines is another solution which is bound to play a very important rôle in the future. Taking as an example a station of 50,000 kw. capacity, operating at 200 lb./in.^{2}, 600 deg. F. and 29 in. vacuum, it is possible to install new boiler equipment for, say, 650 lb./in.^{2}, 850 deg. F. The high-pressure steam is put through a back-pressure turbine, which in this instance can generate about 30,000 kw., exhausting into the old turbines at a back pressure which varies with the load, but which is limited to the safe value for the old turbines. The original hypothetical station may have operated at an efficiency of about 16 per cent; the new combined station can be counted upon to give 23 to 25 per cent over-all efficiency, depending upon the nature of the original turbine equipment.

In such instances there is possible to have: (a) An increase of plant capacity at very nominal cost per kw.; (b) an increase in over-all efficiency without material increase in the total cost per kilowatt. It can be expected that this form of plant enlargement will play a very important rôle in the near future. The superimposed back-pressure turbine can be expected to become even more important when the boiler developments referred to above will materialize.

Economically Equivalent Costs of Power Plants

Ratio of Load to Fixed Part of Cost at 28 Per Cent Efficiency	Over-all Efficiency, Per Cent							
	20	26	28	30	35	40	45	50
40:60	73	95	100	104	113	117	125	129
50:50	59	92	100	107	120	130	136	144
60:40	40	89	100	112	130	146	157	166

The combination of power and steam generation for heating purposes is perhaps the most important feature of all in recent power developments. In the condensing cycle, even in its most ideal form, more than 50 per cent of the available heat energy is dissipated by the cooling water in the condenser. All that the existing heat cycles can accomplish is to bring this waste near the theoretical limit set by the Carnot cycle. In those instances where there are uses for energy in the form of heat a very large portion of it can be recovered.

Factors retarding efficiency improvement

Experience has shown clearly that the existing types of turbine elements, and their combinations, are inher-

From talk before National Association of Power Engineers.

ently capable of approximately the same level of maximum efficiency under appropriate circumstances. The basic efficiency of a reaction stage of great blade heights can probably be brought as high as above 95 per cent. The discrepancy between this value and the present values of turbine efficiency of from 70 to 85 per cent is often a surprise to the purchaser of steam turbines. The principal sources of loss which cause the discrepancy are:

(a) Losses due to the impracticability of having every stage operate at its maximum efficiency.

(b) Leakage of steam in the stage.

(c) Leakage of steam in glands and balancing pistons.

(d) End effects (and leakage disturbances) preventing ideal flow.

(e) Disturbances due to mechanical details such as lashing wires, reinforcements of blades, etc.

(f) Leaving and exhaust loss.

(g) Losses due to the presence of moisture in the low-pressure region.

(h) Mechanical losses due to friction in the steam path, in bearings, etc.

All of these are of importance but not all are equally susceptible of improvement. The first item is chiefly one of a number of stages and general arrangement of blade path. The designer's patience and perseverance are most taxed, particularly for multi-valve turbines.

The leakage problem in the individual stages and at the ends of the cylinders (items b and c) is one of the greatest single items in the list of losses. Variations in turbine designs generally represent variations in leakage details. No other class of detail more forcibly affects the reliability of a turbine. The clearances which are used in modern turbines are necessarily very close, and the possibility of mechanical contact between rotating and stationary parts must be admitted. It is necessary to arrange the sealing details in such a manner, therefore, that the contact has no other consequences than a possible enlargement of the clearance. When all such adjustments have taken place throughout a turbine it must still give its guaranteed efficiency.

Experience has shown that these requirements can be met by thin sealing strips made of special materials which will confine the effects of a contact to the strip itself.

Reaction tests improve design

The general problems of flow disturbances in the blade path (items d, e and f) represent another extremely important group of subjects. With the static reaction tester it has already been possible to establish a blade shape considerably more efficient than our older types, the losses due to lashing wires, the efficiency of various sealing arrangements, the influence of surface finish and polish, etc.

The leaving loss is one of the most important items for condensing turbines, but its magnitude is one of the fundamental quantities which can be influenced chiefly by the size of the last blade annulus. There are other similar losses beyond the last annulus, however, which can be reduced by intelligent design. Studies seem to indicate fairly definitely that for the very large peripheral speeds now in use on large condensing turbines the loss due to moisture in the exhaust is considerably greater than believed formerly.

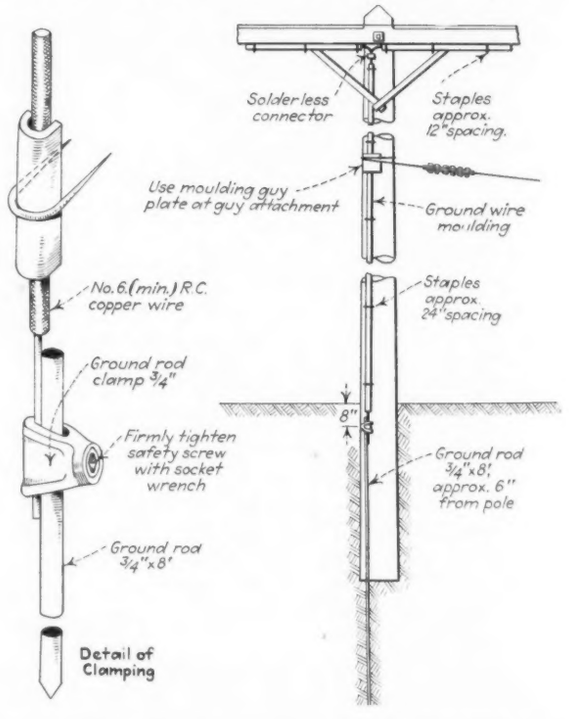
One of the most difficult problems in the design of steam turbines is to give the control system the necessary sensitivity, freedom from oscillations, and reliability. Although the most common type of speed-responsive element is still the flyball type, the fluid type (centrifugal oil pump) appears very logical, since valve operating gears are almost universally of the hydraulic type. Recent developments have led to a construction in which the main oil pump, mounted on the main turbine shaft and having no special pressure characteristics, is connected to a pressure transformer which magnifies and reverses the comparatively weak impulses from the impeller. The magnified impulses are transmitted to the relays of the valve-operating mechanisms, arranged as servomotors. The scheme permits the use of separate fluids for governing and lubrication.

Where the control system must respond to changes of back pressure, as well as to changes of speed, it is necessary to translate back-pressure impulses into the same currency as the speed changes. This is easily done by admitting oil at a pressure, dependent upon the back pressure, on the opposite side of the primary transformer diaphragm. Given the correct ratios of pressures, a rise in back pressure will be synonymous with a rise in speed; that is, both events will cause the governor valve to close.

[Excerpts from the author's comments on erosion and corrosion of blading, scaling of turbines and overcoming fire hazards will be presented separately later.—EDITOR.]

▼

Power System Grounding Rod


Solderless connector
Staples approx. 12" spacing.
Use moulding guy plate at guy attachment
Ground wire moulding
No. 6 (min.) R.C. copper wire
Staples approx. 24" spacing
Ground rod clamp 3/4"
8"
Firmly tighten safety screw with socket wrench
Ground rod 3/4" x 8' approx. 6" from pole
Ground rod 3/4" x 8'
Detail of Clamping

This New England Power System standard employs N.E.L.A. molding (spec. D-190-24) and molding guy plate (spec. D-299-28T). The ground wire is insulated from guys, pole hardware, etc., without sharp bends, and is installed on a street quarter side of the pole in all cases and on the same side as the arresters or other equipment to be grounded.

What Lies Ahead?

Regulation still on trial.
Competition on the decrease.
Things that need to be done.

By C. J. GOODNOUGH*
Chairman Pennsylvania Public Service Commission

WE HAVE seen population thicken in our great cities, have felt the pressure of want and seen the specter of pauperism. To the everlasting credit of the American people be it said that Socialism and Communism are only a cloud the size of a man's hand on the horizon of our country's weal. However, the fates must not be tempted too far and a way out must be found. To be sure, since the nation was born there have been financial crises, panics and depressions. We have even been counseled to take comfort in these periods of misery. Depressions come, we know not whence, and go, we know not how, but come and go they do, to be endured like epidemics of old, as a part of the burden of life. As to epidemics, we have rejected the blindness of such shallow fatalism. Their causes are explored to be known and then to be overcome.

Even if present conditions were but a mirror of the past, it is an abdication of reason to rely on time for correction. Undoubtedly there is still a feeling that prosperity will return with miraculous swiftness. Every day we read and hear of new short cuts whereby prosperity can be restored to the country. It is not for me to compete with these panacea mongers. There are no tricks that will turn the tide. The way out lies in bold and courageous grappling with the basic forces of our economic situation. We have been told and are still being told that the path of wisdom cannot be followed and that the hard road of action cannot be taken because public opinion will not support it. I have not believed that in the past, and I believe it still less today. The one generalization that can safely be made about public opinion is that the public responds to truth telling and courage in high places. There is wisdom in courage.

The function of political and industrial leadership is to lead and not to leave action paralyzed because public opinion is confused and distracted. We must start and start quickly on a program of reemployment. Recovery must deal with faction, population, production, debts, taxes, distrust. To realize that there is a new economic order and to realize it passionately is the equipment for modern statesmanship.

Regulation still on trial

What lies before the electric utilities of Pennsylvania? For centuries the courts have held that certain businesses were affected with a public interest. In simpler days these were few in number and their problems were few in number. With the mechanical inventions of the past half century society has become much more complicated, but in no field so pronounced as in what has come to be known as the field of public utilities. This has been intensified at a rate unknown in human history during the present generation. It is not necessary to explain this before this group, familiar as you are with the huge expansion of capital invested, revenues earned and new types of service developed, particularly since the war. No problem of society, numerous as these have become, is so fraught with controversy and public anxiety as this field. Naturally, two schools of thought have grown up: On the one hand, those who see public ownership of railroads and utilities as the one solution; on the other hand, the opposite extreme view of those who favor a complete "hands off" policy.

In the slow, orderly processes of governmental evolution "regulation" has been the American attempt at solution. Frankly, it is a form of compromise. It is, after thirty-odd years, still in its experimental stage. True, regulation has in many periods and many jurisdictions fallen short of expectations. At the same time its shortcomings have received more notice than its achievements. Perhaps too much was expected of regulation as a device for social control. Perhaps society having passed laws lost interest, as it often has, and expected regulation in the public interest to flow naturally. Meanwhile, holding companies, financial operations on a high scale and all the phenomena of the boom years further complicated the problems of regulation and tended further to irritate public opinion. Now we are probably at a significant turning point in history.

Whatever the next few years bring in the way of economic change, the problem of utilities and their regulation will come in for greater and greater public attention. If

*Abstract of address before Pennsylvania Electric Association.

this be true, can we doubt that it behooves the great utility interests, as well as those public officials charged with the responsibility of regulation, to pause and consider? Are we at this point to contemplate an era of perfunctory regulation, legal jockeying and, to be perfectly frank, a friendly acquiescence by commissions in excessive rates, inadequate service and capital juggling, or are we all going to face the reality that public service companies are in truth what their name implies?

The Anglo-Saxon tradition, unlike the Latin, has been to muddle along. Many public abuses in the past have been tolerated by a public absorbed in earning a livelihood, in golf and in contract bridge. But in the long run, our democracies have exacted accounting. In the utility field, also, the public will eventually exact its highest standards of service at rates fair and equitable. The achievement of these will not be brought about by incantation. The magnitude of the task is appalling, but courage and persistence have solved like problems before along the hard road that men have trodden.

Of course any one familiar with the leadership of the great utility group knows and gladly acknowledges that a sense of public duty and a clear appreciation of the distinct difference between public and strictly private business and a realization of the value of good public relations exists in many quarters. Unfortunately, however, there is another type as well.

However, co-operation on the part of the utility management will be welcomed and encouraged. But evasion, dalliance and defiance will be a challenger to be met with every ounce of strength, ability and fearlessness required.

What lies before the electric utilities of Pennsylvania? First and foremost is to find a way out of the present depression. Employment at a wage that will maintain the American standard of living is the keystone of the arch. In no other way can a purchasing power be created that will utilize the product of mills and factories and produce a market for kilowatt-hours. Agriculture must engage your most thoughtful attention. Here is a market for you, infinite in its potentialities, and you have barely scratched the surface. In Pennsylvania the census of 1930 shows a total of 172,419 farms, and 33,215, or slightly more than 19 per cent, are served by utilities. This does not include farms having industrial plants. While this proves that you have not been wholly idle, for the percentage of farms served in Pennsylvania is twice as large as for the United States as a whole, in six states, California, Rhode Island, Utah, Massachusetts, Connecticut and Washington, more than 50 per cent of all farms have electric service. Since the census of 1930 rural extensions have been made so that on January 1, 1933, you have a total of 13,051 miles of line constructed at a cost of $23,505,113, with a total of 164,625 consumers, which includes 43,158 farms, and an average of 5.7 customers per mile. In 1930 you sold a total of 28,586,000 kw.-hr., which equals 803 kw.-hr. per farm. In 1931 you sold a total of 32,654,000 kw.-hr., or 822 kw.-hr. per farm. The factors which militate most against rural extensions are cost of line construction and indefinite minimum guarantee. This will disappear when line construction is reduced to the lowest standard compatible with safety and the consequent reduction in cost; when, after a fixed period, the percentage minimum is changed to a fixed minimum, or when the consumer is educated to a consumption of kilowatt-hours equal to that which he is entitled to in their minimum guarantee.

Your urban areas present problems immediately pressing and important. A great President of the United States once remarked that "The Lord must love the common people because he made so many of them." The common people constitute the great majority in number of your customers. We may consider as the "ordinary" domestic consumer one who uses about 40 kw.-hr. per month. A study reveals that this class of customers in cities with a population of 50,000 and over pay monthly bills ranging from $3.40 in Allentown, Bethlehem and Reading to $3 in Scranton. The average rate in most of this territory comes to about 8 cents per kilowatt-hour for this class of customers. While, of course, 8 cents is nothing like the average price received by the utilities for a kilowatt-hour, you must consider whether or not you are placing a "crown of thorns upon the brow" of so large a number of your customers, and if so, should the lower brackets be adjusted, even at the expense of the higher?

Are rates too high?

In the last analysis the big question is: Are electric rates too high? The answer is necessarily predicated upon a fair return upon a valuation properly established. Numerous theories have from time to time been advanced as to what constitutes proper valuation—prudent investment, reproduction cost less depreciation, etc. In 1898, in its famous case of Smyth vs. Ames, the Supreme Court of the United States established the reproduction cost theory as one of the rules for rate cases. This was well for the utilities while prices were on the uptrend, but with rapidly declining prices the answer to appeals for lower rates was that rates have come down. In a sense this is true. Certainly electric rates are lower today than in pre-war days, which seem to be regarded as a period of extremely low prices. But that is hardly a fair test.

Undoubtedly, technical improvements, natural operating economies and increased consumption per customer would have made reductions possible aside from the general decline in prices. Perhaps a fairer test would be to compare the general declining price list with declining utility rates. The cost of living index of the Department of Labor on December 31, 1929, stood at 171.4, as against 132.1 on the same day in 1932. A decline of 22.9 per cent in the three-year period. In 51 cities domestic electric light rates declined only 4½ per cent in the same period, or only about 20 per cent of the cost of living trend. This is particularly striking when it is considered that the average use of current per domestic customer was more than 20 per cent greater for 1932 than for 1929, rising from 500 to 607 kw.-hr. per annum. The National Industrial Conference has just estimated the national income at forty billion dollars for 1932, as compared with eighty-five billion dollars for 1929, a drop of 53 per cent.

The question of competition cannot be entirely disregarded, nor can it be assumed that electric utilities, *per se*, have a natural monopoly. The Diesel engine is no longer an experiment and municipally owned plants provide an equation well worthy of your consideration. The Mayor of Bethlehem in his report for 1932 said: "Not that I am advocating public ownership of all utilities, yet

it is my belief that if the city owned and served our citizens with these necessities of life, the profits now going to a few people throughout the country would, to a large extent, offset our total taxation. I have arrived at the above conclusion as a result of investigation and study of what has actually occurred in many communities throughout our country.

"A most striking example is the city of Jamestown, N. Y., which owns and operates a municipal electric plant serving the water pumping station and street lights and sells power to its citizens.

"Quoting from an article of the April, 1932, issue of the *American City*, the following statement should be of interest to our citizens, notwithstanding the fact that Jamestown is credited with the lowest lighting rates in New York State. 'The surplus has increased from $137,000 in 1912 to more than $2,000,000 in 1930. The plant has paid all expenses and its entire bonded debt out of revenue without any assessments against the taxpayers. The city is now engaged in placing all transmission lines in underground conduits, all such improvements being made from earnings, placing no additional burden on the taxpayer. Comparing the rates with those charged, until recently, by the competing company in districts without municipal competition, there would be sufficient profit to eliminate entirely all taxes for city and local school purposes.'"

In conclusion, perhaps some of you are already thinking that I am a pessimist, a wet blanket and no good, but that is not entirely true. I can see much that is good in the present situation. I can see kilowatt-hours going into the mansion of the rich and the cottage of the poor, dispelling the gloom; doing much of the drudgery of the world and creating beauty and joy where before was darkness and despair, and I look forward hopefully to the time when electric utilities will have created for themselves an asset which, while it cannot be carried in the balance sheet, is of value that can hardly be computed—that asset being a constituency of contented, satisfied and co-operating customers—and when the Public Service Commission will not be receiving from forty to fifty letters daily, as it now is, complaining of rates, billings, service and this and that.

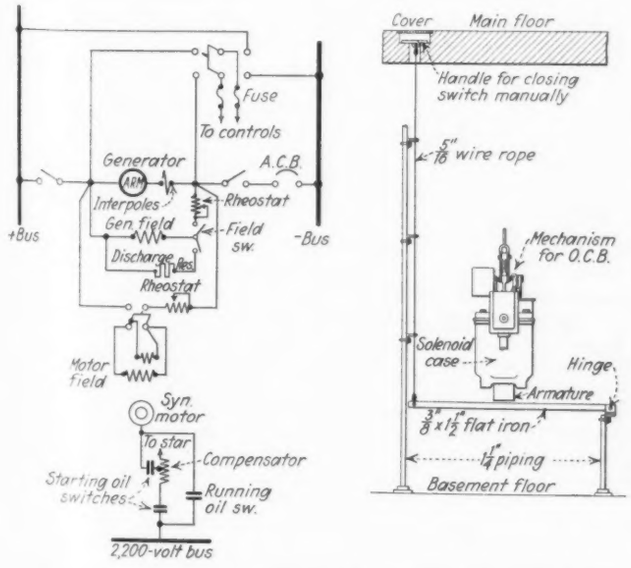
In the meantime, a platform upon which we can all safely stand was erected by a wise old King, who had much experience in governmental and industrial affairs, when he said that "Righteousness exalteth a nation, but sin is a reproach to any people."

▼ ▼ ▼

Starting an M.-G. Substation After Plant Shut-Down

By S. EIN
Hammond, Ind.

How to get the motor-generators back into operation after a plant shut-down was the question that arose concerning substation operation in a large Middle Western steel mill. The switches are operated by direct current from the substation bus and, of course, when the machines are down this bus is dead. An obvious answer would be to install a standby battery in a key substation, but a 250-volt battery of sufficient capacity to work the heavy solenoids of the switch mechanisms is quite expensive. A simpler and much less costly way was devised. The accompanying sketches show how it was done.



Control energy may be obtained from armature of starting generator (left). By lifting solenoid armature automatic switch may be closed manually (right)

In one substation housing two 1,000-kw. synchronous-motor direct-current generator sets the starting and running oil switches are installed in the basement. All are solenoid operated through the usual control relays and pull switches. To allow the two oil switches of one set to be closed by hand, levers were installed under the armatures of their solenoids. The levers are hinged at one end and at the other end are joined to wire ropes running up to handles set in pockets in the main floor. A small double-pole, double-throw knife switch was mounted on the switchboard to let the control be energized from either the bus or generator armature. During normal operation the switch is left on the bus side.

When the plant's power stations are shut down—by lightning or other causes—and then started again, alternating-current power is supplied first. Direct-current power cannot be supplied because all substations are down. The operator of this substation closes and latches the two starting oil switches on the compensator of one motor-generator set. It is thus started and is allowed to reach full, or nearly full, speed. Since the generator is self-excited, the voltage can be, and is, built up to 250. The control switch is then changed to the generator side to make available a source of energy to the control apparatus. The remainder of the starting sequence is then followed as in normal operation: Field is applied to the motor, the oil switches are changed from starting to running and the generator is connected to the substation main bus. The other motor-generator can now be started and also placed on the bus. Feeder lines are closed and life-giving energy is pumped into the direct-current system where dormant motors, lights and other apparatus are awaiting it and the production of steel again proceeds.

Practices Instituted for Economy

THE past three years has been very fruitful in stimulating or re-emphasizing economy measures, some of which deserve continuance even under improving business conditions, while others might be modified or eliminated. Some of the practices instituted before the current uprise, by a utility serving a territory which suffered as much as any, are cited from its own report:

A—System as a Whole

Instead of laying off men and thereby depriving them of any income when business was dropping, available work was distributed among all employees by reducing the hours of work and corresponding pay of each. In this way each one contributed through sacrifice to the common welfare of his fellow workers. For example, operators who formerly worked seven days a week and nine hours a day, with little time for recreation, now have two days free at intervals of five to seven days so they can utilize their spare time to better advantage. They work eight hours per day for seven days on night shift, take two days off, work eight hours a day for five days on the day shift and take two days off, repeating the cycle. This gives them an average of 48 hours work per week.

Private use of company automobiles has been discontinued and the cars are assigned on a taxi basis as needed to secure the maximum return on the investment. Through this change employees are forcibly reminded to consider whether an automobile is essential where other means of transportation—street cars, buses, etc.—are available.

Allowance for lunch money while out on the system has been eliminated on the basis that it is no more expensive for employees to buy lunches there than when at headquarters.

Records, reports and log sheets have been analyzed to ascertain the use made of them. Those which have been retained because of tradition only are discontinued. Some were found that had not been utilized to the extent they could be and are now analyzed regularly for guiding economic operation. Every trouble, if analyzed, shows means of preventing recurrence. But any contradictory evidence indicates that the correct solution has not been found.

A careful study of all repair and maintenance jobs is made to prevent recurrent failures and to reduce the costs of normal maintenance. The use of electric welding has materially reduced maintenance costs. Redesign of parts, particularly stokers, has resulted in large savings.

The basing of inspection schedules on the condition in which equipment is found and the accumulated duty between inspection periods has increased the interval between scheduled inspections without the sacrifice of safety. Costs of maintenance are carefully checked to see where money is going.

By carefully planning inspection and repair work, labor and material used is reduced and efficient units are available for operation a larger percentage of the time. This reduced the amount of energy which must be generated on less efficient equipment. Both inspection and maintenance are done by the same group so inspection will not be slighted at the expense of maintenance.

A system of thoroughly analyzing costs and distributing such information to all key men has developed a cost-minded personnel. The workmen have been familiarized with the value of the equipment they work on, the cost of the tools they work with and the material and supplies which they use. The foremen have available the costs of their various jobs in detail, which enables them to determine the efficiency with which each was performed. This is used as a guide for future work and is valuable for making comparisons. The foremen's superior is also able to judge his foremen's ability to a large extent by a perusal of this information. Information is available on the upkeep cost of each piece of equipment so that changes can be made when such cost becomes excessive. This information is also used in connection with deciding on the type of new equipment to be purchased.

A class of instruction for key men and operators who are charged with the operation of major equipment has produced definite beneficial results.

Every man in the plant has been made to feel that he has a very definite part and responsibility in the plant operation, maintenance and costs. Suggestion system has proved of value, but men are encouraged to make suggestions direct to foremen rather than through the usual suggestion box methods.

A fine spirit of helpful co-operation has been developed between the heads of the various departments of the organization engaged in this work. This spirit exists not only between the department heads themselves but extends throughout the entire organization. The men are not only co-operating with each other but they are co-operating with the company in the attempt to make the best showing possible.

By the reduction of material carried as spare parts, material regularly used in operation and maintenance and the reserve coal supply, to the minimum amount necessary to safe operation, the cost of carrying charges and the factor of obsolescence has been reduced.

Instruction of all employees with regard to safety reduced the accident cost.

A study of personnel with regard to quality and proper division of work has produced an efficient organization.

B—Boiler and Turbine Room

Banking of boilers is carefully studied and boilers are put in a live or a dead bank or taken out of service entirely as load conditions require. It is frequently possible to load the remaining boilers more efficiently by banking some boilers during light-load period. This problem is not left to the guess of the operators.

Boiler meters show the operator the relation of air flow to steam flow at all times, thus allowing him to carry the proper CO_2 for efficient operation. Complete coal analysis and ash analysis of each boiler every 24 hours, together with rating and CO_2 determinations from boiler charts, give each operator a quick report on the result of his boiler operation.

A standard for economizer performance is applied each day to each economizer and any economizer falling below standard is washed promptly.

Similar tests and actions are applied to superheaters.

As we secure our major coal requirements from company-owned mines, a study of coal quality and production costs is enabling us to secure maximum benefit for money expended for coal. The same results are also being obtained in connection with coal purchased, in that coal with characteristics best suited to our needs is being secured.

By a study of and changes made to forced- and induced-draft fans higher boiler ratings are now being secured, making it possible to get more steam from boilers with economizers.

Boilers are blown down only when concentrations reach a predetermined value, thus keeping the loss due to this cause to a minimum. Blow-down valve leakage is watched carefully.

Reducing air leakages to boiler breechings and economizers to a minimum. The amount of leakage is measured each week.

Taking warm air from the building for forced-draft fans (air preheaters are not used and economizers are installed on only half of the boilers).

Efficient distribution of load between house units and auxiliary transformers to maintain proper heat balance between extraction from main units, load on auxiliary turbines exhausting into feedwater heating system, economizer and evaporator operation.

Efficient use of steam-driven auxiliaries.

Condensate piping was changed to take maximum advantage of extraction heating. Schedule of operation of feedwater make-up evaporators put in effect to maintain bleeding cycle at highest efficiency.

Daily checks of condenser performance and cleaning when below standard for given water and steam conditions.

Operators make a check each shift for air and water leakage in condensers.

Scheduled operation of one or two circulating pumps, depending on river water temperatures and load. Similar schedule for operation of air ejectors.

By resetting the turbine spindles of our units so that the impulse blades are as close to the nozzle block as is consistent and practicable with good safety, it was possible to reduce considerably the leakage past the dummies and blading in the conical-bore sections, which resulted in a substantial increase in the efficiency of the turbine and larger output from more efficient units.

By the use of a turning gear which keeps the turbine spindle from excessive warping when the unit is out of service for short periods, the machine can be returned to service in about one hour without the attendant danger of damage to the unit. This allows for shutdowns when unit is not needed for short periods, thus saving steam and auxiliary power during useless operation and during long starting periods.

▼ ▼ ▼

Grid Control of Mercury-Arc Rectifiers

By OTHMAR K. MARTI

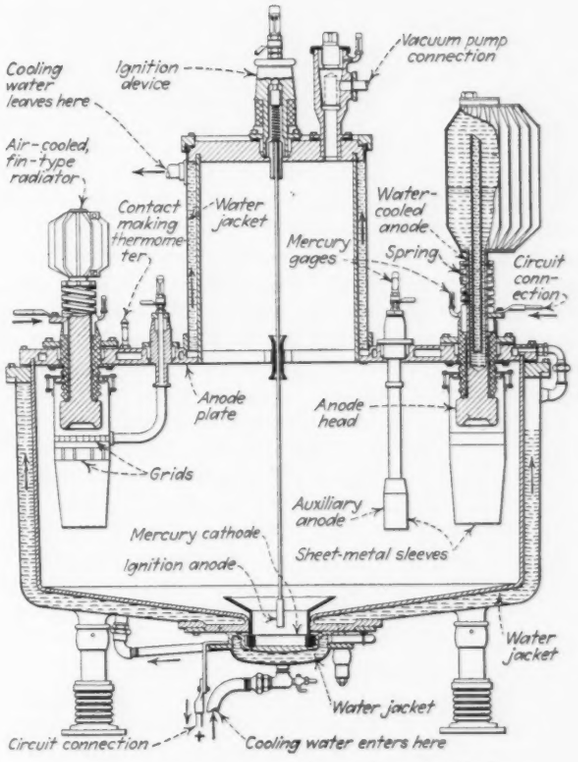
Engineer in Charge Rectifier and Railway Equipment, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

REGULATION and control of the direct-current output voltage of a mercury-arc rectifier by means of energized grids is an accomplished fact. A twelve-anode rectifier of this type rated at 5,000 amp., nominal 625 volts direct current, was installed by the Commonwealth Edison Company, Chicago, and has now been in operation for several months. In it the grid-control equipment is arranged so that the d.c. voltage can be maintained within the desired limit at all loads without the use of tap-changing equipment and without interrupting the flow of power. Grids next to the anodes are made of graphite, are insulated from the anode housings and the grid leads are brought to the outside of the tank through bushings in the anode plates. The rectifier d.c. voltage is controlled by impressing a suitable potential on the grids by means of these leads to control the instants in each cycle when the anodes are permitted to fire or to start.

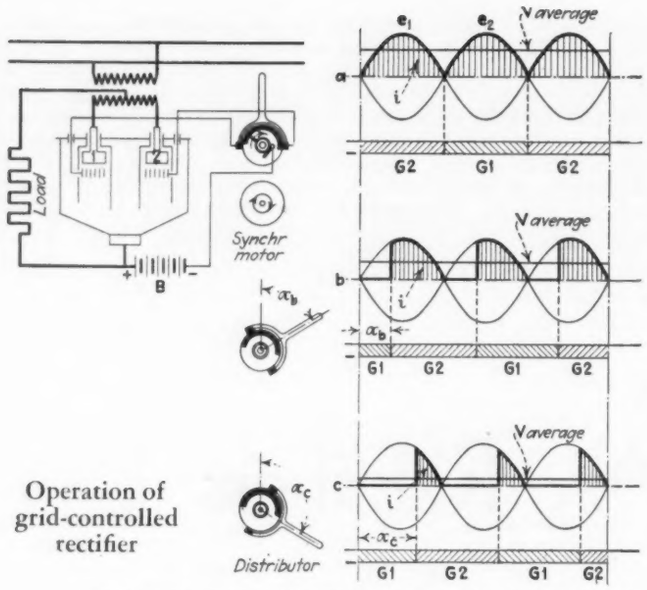
In this installation the method by which the control is accomplished is similar to that shown in an accompanying drawing except that electrical means are substituted for the mechanical distributor shown in the drawing. The auxiliary apparatus necessary in connection with this control consists merely of a small auxiliary transformer, resistances and the necessary switches and fuses and, since only a fraction of an ampere is needed to energize the grids, these devices are of very small capacity.

No trouble has been experienced in the operation of this rectifier in regard to blocking action by the grid and so far with no backfire disturbance, although the voltage is being controlled at currents as high as 6,000 amp. This point is emphasized particularly as this type of grid control has been the subject of much discussion and there may be some who have the impression that it is not practical. The principal difficulty which had to be overcome was due to delayed picking up of the anodes from no load and a change has been made in the cooling system which has improved this condition.

Extensive investigations carried out during the past two years in the laboratories of Brown, Boveri & Company, Ltd., in Baden, Switzerland, have led to the invention of a new type of grid which makes possible the interruption of anode currents of considerable magnitude in vapor or gaseous types of electric power valves without producing an excessive voltage drop in the arc. It is therefore possible with this new type of control to interrupt the flow of current at any instant during the firing period. Previous practice had included only the control of the initiation of firing by the grids, the anode current continuing to flow until it had declined to zero at the end of the half cycle. This new development enables the succeeding anode to pick up current even when its voltage is lower than the voltage of the anode whose current is interrupted. Consequently, the firing periods of the anodes can be advanced by any desired angle, thus



Cross-section through grid-controlled mercury-arc rectifier



Operation of grid-controlled rectifier

Each anode carries the whole current for the half cycle, during which it is positive with respect to the cathode, whereas during the other half cycle it carries no current. If now a positive potential is applied to the grid by the battery the same action will take place; that is, the alternate presence and absence of current through each anode is repeated once every cycle. In case both grids are negatively energized no current will flow from either anode to the cathode, and if only one grid is made negative the current can flow only from the other anode. If the grid of an anode is energized negatively after current has started to flow from that anode the current will keep on flowing until it passes through zero (see detail a). In other words, the current flow can be prevented from starting at any anode, but, once started, it cannot be stopped by any of the grids used in present mercury-arc rectifiers.

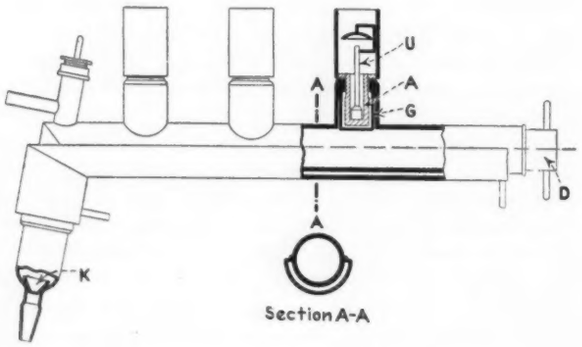
If the contact handle of the synchronous switch is turned to the right, so that the firing point is retarded, the current flow is decreased from a complete half cycle as shown in detail a to two-thirds or one-third of a half cycle as shown in details b and c respectively. The further the point to which the grid voltage is maintained negative is retarded the shorter will be the period during which the anode carries current. From the detail drawings it can be seen that as a consequence the direct-current voltage is lowered. It is seen that the current and voltage are in phase in detail a and are more and more out of phase in b and c; that is, the input power factor to the rectifier decreases as the direct-current output voltage is lowered by means of grid control.

It is apparent that if the firing of the anode is delayed 180 deg. the direct-current voltage will be zero, and if it is further delayed the rectifier can be made to act as an inverter if direct current is applied to the rectifier terminals. It is therefore possible to make the mercury valve with grids operate as a switch, a rectifier or as an inverter simply by controlling the instant at which the grids are energized and the polarity of the energizing voltage. Similarly, operation as a frequency changer can be obtained. Moreover, since several thousand amperes can be controlled with only a fraction of an ampere grid current, the switching and regulating devices can be made very small.

resulting in a leading power factor. Some of the new possibilities from this development of the grid-controlled power valve are immediately apparent, namely, as a static condenser, for compensating lagging current, for frequency changing and, as a matter of fact, for the universal control and conversion of power. This development is therefore a marked advance in the electronics art. A simplified rendering of the design of this new development is shown in an accompanying sketch.

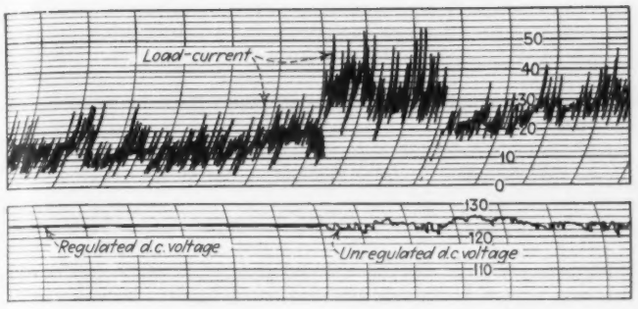
The practicability of grid control of mercury-arc rectifiers demonstrated by the operating installations cited in text and illustrations of this article furnishes ground for the belief that the mercury-vapor arc valve will soon occupy just as important a place connected directly into power circuits as is given now to the vacuum tube as a regulating and controlling device. Grid control of mercury valves opens up wide possibility for the use of this valve in motor applications, power-factor correction, inversion, switching, etc. It may be worth while here to explain in some detail the operation of grid control in mercury valves in distinction from the grid function in the vacuum tube.

In the vacuum tube the grid acts like a resistance introduced into the electron path and it exercises a continuous control over the flow of anode current. The regulating losses of the grid in the vacuum tube are high and for this reason the vacuum valve is not suitable for power application. In the mercury valve current starts flowing as soon as voltage is applied between the anode and the cathode provided a cathode spot is established and provided the grid is not negative; a positive grid potential aids in establishing the current flow. The voltage drop in the arc is small, of the order of 15 to 30 volts. The magnitude of the anode current depends only on the impedance in the external circuit. Once the current has started to flow no negative grid voltage, however high, can stop the current again when conventional grids are used. If alternating current is applied to the anode of the mercury valve and no grid control is present, or, being present, if the grid potential remains continuously positive, current will flow through the valve only during the positive half cycle. This is the conventional operation of the mercury valve as a rectifier. By making the grid potential negative and keeping it so for a part of the positive half cycle a greater or less amount of current during that cycle is permitted to flow. In effect, the grid allows a single-anode rectifier to be operated as a half-wave rectifier, which is its full capacity, or as a rectifier of one-third, one-quarter, one-eighth, one-sixth or any fraction of the positive half wave. The



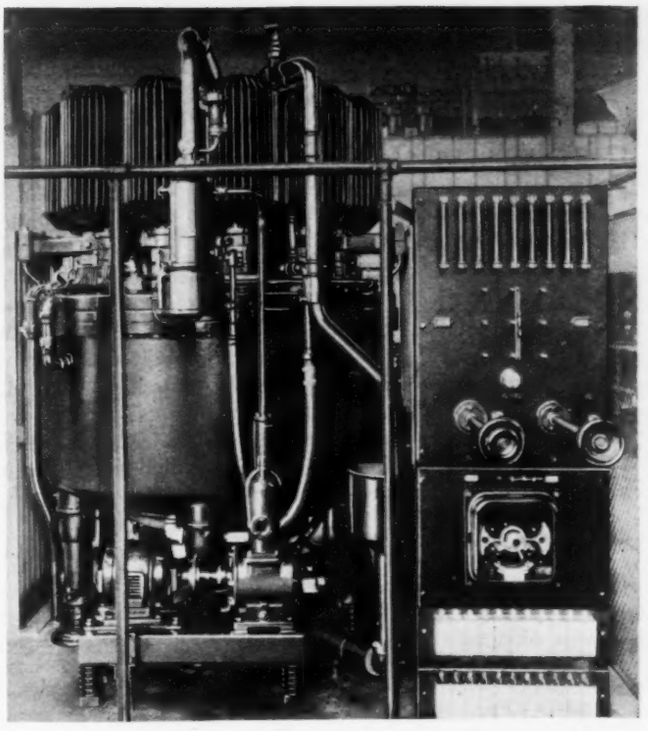
Mercury valve with complete grid control

This new design includes the stoppage as well as the initiation of anode current by grid control. Three anodes protrude somewhat into a water-cooled steel tube. Anode *A* with shaft *U* is surrounded by a cup-shaped grid *G*, having a number of small openings, which incloses the active surface of the anode and which is located a certain distance away from it. The cathode *K* is located at some distance from the anode and is energized by means of an arc flowing between the excitation anode *D* and the cathode *K*. The ionizing properties of this excitation arc to which the anode surfaces are exposed therefore eliminate all difficulties in the picking up of the load. With this device currents up to 100 amp. at several hundred volts were successfully controlled. Thorough tests were made for over a year and the principle has now been applied to rectifiers of conventional design.



Voltage regulation by grid control

The lower curve indicates the direct-current output voltage at the load indicated by the current graph above it. In spite of considerable current swings, the voltage remains practically constant as shown by the right-hand part of the lower chart.



Grid-controlled mercury-arc rectifier in operation

Supplying a traction load, this 5,000-amp., 625-volt direct-current rectifier with its automatic grid-control equipment has been in operation for nearly a year. The control board is shown on the right-hand side and contains the necessary grid control equipment, including a quick-acting rocking contact type regulator for automatically controlling the output voltage of the rectifier. With this control the voltage can be kept constant over a wide load range or, if desired, a compound voltage characteristic can be obtained.

time of potential change on the grid from negative to positive determines the time at which current flow is initiated from the anode. Therefore, by arranging the grid control to change from negative to positive at a given instant in each succeeding half cycle, when the anode is positive with respect to the cathode any proportionate part of the positive half cycle may be allowed to flow through the rectifier. Thus greater or less amounts of the current available from the alternating-current supply may be allowed to pass through the rectifier with corresponding changes in the average direct-current output voltage.

The above-described operation depends upon the ability of the positive grid to initiate anode current. However, in this operation the negative grid has no capacity to reduce or to stop anode current once it is established. Anode current stoppage depends upon the normal cessation of current flow at the end of the half cycle.

The new development to which reference was made earlier in this article removes this limitation from the mercury-arc rectifier. In the proposed design the grid, according to the polarity of the potential impressed upon it, can not only initiate current flow at any time during the cycle but can also stop it at any time. This development, in effect, gives to the mercury valve characteristics comparable to those of the vacuum tube and opens up to the mercury device, with its capacity for operation at low arc drop voltage and high current values, many of the possibilities of application promised by the vacuum tube. The mercury valve may appear in diverse forms.

▼ ▼ ▼

Vacant Store Not Necessarily a Lost Customer

By M. W. ROSS

Lighting Sales Department,
*Commonwealth Edison Company, Chicago, Ill.**

Early in 1932 it became evident to the Commonwealth Edison Company that vacant stores in Chicago were not to be reoccupied in great number immediately. The previous practice of leaving meters set in these establishments until they were reoccupied was abandoned and the systematic removal of meters from vacant stores was started. The lighting sales department secured copies of these meter-removal slips. We called on the owner or agent of the premises ahead of the removal of meters and attempted to induce him to retain the service in his own name and to use it to supply a lighted "For Rent" sign. We offered such a sign at a price of about $3.50, depending on the lettering, and were able to dispose of more than 150 of them. These signs used a 60-watt lamp operated on a socket flasher. Other owners retained the service so they would be able to keep window lights burning as an advertising feature. In one month a total of 1,316 meters were removed in commercial establishments, of which 1,061, or 80 per cent, were on account of vacancy. Out of this lot we secured 84, or 6.4 per cent, new applications for service in this way.

Calling on the owners or agents of vacant stores, which at first seemed rather futile, developed into a worth-while activity. Our representatives became acquainted with these people and were able to obtain first-hand information as to possible tenants. When leases were closed with these new tenants we were in a position to solicit them for lighting and appliance business. As a matter of interest, vacant stores in Chicago

**From paper to 1933 convention of Illuminating Engineering Society.*

are now (August, 1933) being occupied at the rate of more than 100 per week. (Editor's note—Beer taverns starting up at beginning of half-year license term.)

▼

Electricity Not Dangerous

Within the city limits of Chicago live 3,376,438 people. In this number of people there were eight fatal electrical accidents in 1932, according to the recently published annual report of the Chicago Department of Gas and Electricity. Of the eight at most four can be said to be directly attributable to accidental contacts with wiring and equipment used in home or industry. But assuming all eight fatalities as due to faulty materials and devices, the ratio of deaths to population is 0.0000023, or about two in a million. Statistics thus show that electricity in actual use is infinitely less dangerous to life than many other common hazards that are given far less thought in safety standardization. The record:

1. Electrical equipment involved—Extension cord.
Injury, shock. Voltage, 115 a.c.
Occupation, watchman. Age, 40.
Location of accident, boiler room of a laundry.
Contacts—Hands on wet brass shell of socket attached to an extension cord, feet on wet cement floor.
Defects—Type of socket not approved for location or use.
Occupation at time of accident—Cleaning boiler.

2. Electrical equipment involved—Extension cord.
Injury, shock. Voltage, 115 a.c.
Occupation, bathhouse attendant. Age, 48.
Location of accident—Passageway in basement of public bath house.
Contacts—Some part of body (naked and wet at the time) with the cord while standing on damp earth floor.
Defects—Insulation of N.E. Code Type C lamp cord cracked in many places, also a splice insulated with medical tape.
Occupation at time of accident—Walking through passageway.

3. Electrical equipment involved—Portable electrical drill.
Injury, shock. Voltage, 3 phase 220, maximum to ground approximately 190.
Occupation, laborer. Age, 57.
Location of accident—Coal storage yard.
Contacts—Frame of portable drill to earth.
Defects—Insulation failure; cause unknown.
Occupation at time of accident—Drilling holes in conveyor.

4. Electrical equipment involved—B battery eliminator for radio receiver.
Injury, shock. Voltage, depending on terminal used, maximum 200 d.c.
Occupation, structural iron worker, unemployed. Age, 47.
Location of accident—Bedroom in rooming house.
Contacts—Bottom sections of safety razors, one on each breast held in by a belt and attached by flexible wires to the d.c. terminals of a B eliminator.
Occupation at time of accident—Experimenting with electrical treatment.

5. Electrical equipment involved—Radio receiving set and microphone.
Injury, shock. Voltage, d.c. 245.
Occupation, school boy. Age 18.
Location of accident—Living room of his home.
Contacts—Metal case of microphone in one hand with the other hand on metal chassis of the receiver.
Defects—Designed and connected so that plate potential of detector tube exists between case of microphone and ground terminal of the receiving set.
Occupation at time of accident—Connecting the microphone to receiving set in order to reproduce his voice in the speaker.

6. Electrical equipment involved—Third and running rails of elevated railroad.
Injury, shock. Voltage, d.c. 600.
Occupation, switchman. Age, 28.
Location of accident—Terminal yards of elevated railroad system.
Contacts—Body across third and running rails.
Defects—None; heavy rainstorm was a contributing cause.
Occupation at time of accident—Switching cars; slipped on wet tie.

7. Electrical equipment involved—Light pole of street lighting system.
Injury, shock and skull fracture. Voltage, a.c. 2,300.
Occupation, school boy. Age, 18.
Location of the accident—Metal light pole on city street.
Contacts—One hand on lamp housing, the other hand and both feet on the pole.
Defects—None; a trespasser trying to remove the lamp.

8. Electrical equipment involved—Wires of street lighting system on poles and running through trees.
Injury, shock and skull fracture. Voltage, 2,800 a.c.
Occupation, school boy. Age, 18.
Location of the accident—Tree on city street.
Contacts—One hand on wire, the other hand and feet on cottonwood tree.
Defects—None.
Occupation at time of accident—Playing.

▼

READERS' FORUM

Radio City Lighting Controls Had Predecessors

To the Editor of the ELECTRICAL WORLD:

My attention has been called to an article appearing in the August 26 issue of ELECTRICAL WORLD entitled "Refinement in Controls Marks Radio City Music Hall," and especially to Figs. 4 and 6 on page 279.

Referring to Fig. 4, the text would give the impression that the method of obtaining proportional dimming, outlined therein, was used for the first time in the Radio City installation. I would point out that in 1931 the writer designed an illumination control system which was installed at the Longwood Farms estate of Pierre DuPont, near Wilmington, Del., and that this system provided proportional dimming effects obtained in almost identically the manner described in Fig. 4, above referred to. This system was described in an article published in *Better Theatres,* dated August 1, 1931. Diagram on page 16 of this magazine shows grand master and individual control units connected exactly as shown in Fig. 4 of the article in your issue of August 26.

In the *Better Theatres* article the writer described his method of obtaining proportional dimming and defined it as "Change of intensity without change of hue," which is practically identical with the definition given in the aforementioned ELECTRICAL WORLD article.

The article in *Better Theatres* also described a fader system which accomplishes the same results as the fader system described in Fig. 6 on page 279 of the ELECTRICAL WORLD.

So far as the writer knows, the first published description of an electrically controlled proportional dimming system (to be used "with or without electronic tubes") is contained in an article written by the undersigned in 1930 and published in the latter part of 1930 in the *Exhibitors Herald-World.* This system is shown in practically identical form in patent 1,682,566, issued August 28, 1928, to Hunter and Evans.

R. B. HUNTER,
Development Engineer.
Cutler-Hammer, Inc., Milwaukee

Men of the Industry

L. O. Ripley Heads Kansas Gas & Electric

L. O. Ripley, for many years vice-president and general manager of the Kansas Gas & Electric Company, Wichita, has recently assumed the duties of president of that company. Mr. Ripley has been an important factor in

utility development in the Middle West since 1909 when, after affiliating himself with the American Power & Light Company, he was sent to Kansas as field executive of Kansas Gas & Electric. During his connection with the electrical industry in Kansas he has been active in state and national associations, having served as president of the Middle West Division of the old National Electric Light Association.

A native of New York, Mr. Ripley entered the electrical industry during his high-school years, when he worked in the electric light plant at Cooperstown, N. Y. Following graduation in 1900 from Union College, Schenectady, as an electrical engineer, he engaged in outside construction work until 1903, when he joined the Schenectady Railway Company, which at that time also operated the electric light and power business as well as the gas business in Schenectady. Mr. Ripley was made superintendent of light and power and when the railway systems were sold he became manager of the Schenectady Illuminating Company and remained there until he allied himself with the American Power & Light Company.

▼

ARTHUR J. TURNER, construction engineer for the Washington Water Power Company, has been appointed chief engineer, succeeding Victor H. Greisser, resigned. Mr. Turner has had extensive experience in engineering work in the state of Washington. He was identified with the Skagit development of the Seattle City Light Department and was later chief engineer for the Columbia Basin Irrigation League. He became affiliated with the Washington Water Power Company in 1926 as resident engineer at the Chelan development.

▼

OBITUARY

Farley Osgood

Farley Osgood, consulting engineer and for many years a prominent figure in the electric light and power industry, died October 6 after several months' illness. He was fifty-nine years of age.

A native of Boston, Mass., and a graduate of the Massachusetts Institute of Technology, Mr. Osgood started his career in the public utility industry in 1897 as a telephone engineer, with the American Telephone & Telegraph Company, then known as the American Bell Telephone Company. After a period of five years in the course of which he had risen to the extent of becoming a territorial manager in New Jersey, he became engaged in high tension work and finished the construction of the New Milford Power Company's plant on the Housatonic River in Connecticut, developing its transmission system, organ-

izing the operating force and acting as its chief engineer and general manager for some four years.

From New England Mr. Osgood returned to New Jersey, to become general superintendent of distribution for the Public Service Electric Company at Newark. It was not long before his capability won recognition and he was soon directing the production department and in addition the engineering department. In the spring of 1917 he was appointed vice-president and general manager of the company, in this capacity being responsible for the operation and engineering of one of the largest light and power utilities in the country. He resigned from this executive position in 1924 and later established consulting engineering offices in New York to engage in the design, construction, operation and interconnection of public utilities.

In the course of his career Mr. Osgood gave much of his time and energy to certain phases of association work. From 1924-1925 he served as president of the American Institute of Electrical Engineers, having previously been a member of many of that association's committees, including the standards, Edison Medal, overhead and underground line construction, executive, finance and several other committees. As a representative of the A.I.E.E. he had much to do with the formation of the National Electrical Code, so well known as the standard specification for interior wiring. In the National Electric Light Association, Mr. Osgood was also very active, having been a member of the executive committee of the Technical Section and its vice-chairman as well as the recipient of numerous committee appointments in that society.

▼

JOHN C. HENDERSON, for the past twenty years consulting engineer of the Driver-Harris Company, Harrison, N. J., died September 25, at the Elizabeth General Hospital, in his fifty-seventh year. Mr. Henderson held thirty or more patents.

•

LOUIS J. HIRT, retired consulting engineer of the Brazilian Traction, Light & Power Company, died in New York September 20, of a complication of ailments. He was 79 years of age. Until his retirement in 1921 Mr. Hirt had spent 30 years in the development of the hydro-electric properties of the Brazilian company, the Mexican Light & Power Company, Winnipeg Electric Company and the Toronto Power Company.

•

HARRY A. CURTIS, chief engineer and general manager of the hydroelectric department, Government of Tasmania, Hobart, died May 20. He obtained practical experience in general engineering work in England and New Zealand, his native country, before going to Tasmania in 1916 as power station superintendent of the hydroelectric department. In 1919 Mr. Curtis became chief operator of this department in charge of power stations, substations and transmission lines. After serving as construction engineer, engineer for electrical design and chief as-

sistant engineer, he was appointed chief engineer and general manager in 1924.

•

ALBERT C. AREND, 64, federal public works engineer for Nebraska, died suddenly in Omaha, October 2. He had just completed for the government a survey of the five different power-irrigation projects in Nebraska asking government aid. A graduate of Rutgers, Mr. Arend had supervised large projects in this country, Nicaragua and Cuba. He was one of the group of engineers that surveyed the proposed Nicaraguan canal, abandoned after Panama was secured. He installed a plant for the Ontario Power company at Horse Shoe Falls and built a number of hydro-electric plants in Nebraska.

•

EDWARD D. KILBURN, formerly vice-president and general sales manager of the Westinghouse Electric & Manufacturing Company, died suddenly October 4 in New York City, in his fifty-ninth year. For many years Mr. Kilburn had been prominent in the electrical industry. He became identified with the Westinghouse organization in 1906 and during his long period of service rose steadily, becoming in turn manager of the New York power and railway department, manager of the New York district office, vice-president and general manager of the Westinghouse Electric International Company, and sales executive of the Westinghouse Electric & Manufacturing Company. In connection with his position with the Westinghouse Electric International Company, Mr. Kilburn traveled extensively abroad. He was a member of the A.I.E.E.

•

CHARLES PIEZ, chairman of the board of the Link-Belt Company of Chicago, died of pneumonia at Garfield Hospital, Washington, D. C., October 2. He was 67 years of age. Because of his ability as organizer, Mr. Piez was selected to head the Emergency Fleet Corporation. Born in Germany, Mr. Piez studied mining engineering at Columbia University, New York. After graduation in 1889 he entered the employ of the Link-Belt Engineering Company in Philadelphia. He attained to the position of chief engineer and general manager of the Philadelphia works and in 1906 was elected president of a consolidated organization of the three related companies, the Link-Belt Machinery Company, the Ewart Manufacturing Company and the Link-Belt Engineering Company. It was in 1924 that he became chairman of the board, from which office he retired last spring. Mr. Piez was a past-president of the American Society of Mechanical Engineers and served twice as president of the Illinois Manufacturers Association.

New Equipment Available

Smoke-Density Indicating and Recording Equipment

Photoelectric equipment for indicating and recording the degree of density of smoke passing through the stacks or breechings of power and heating plants has been announced by the General Electric Company. Changes in smoke density are indicated on a meter. A running record of the amount of smoke passed up the stack may be obtained by the addition of a recording instrument.

The essential elements of the apparatus are: A light source and a photoelectric relay unit; the recording instrument is optional; the photoelectric unit and the light source are designed for mounting on opposite sides of the stack so that the light beam from the light source passes through the stack and falls on the phototube.

▼

Capacitor-Start Induction-Run Motor

Capacitor-start, induction-run Emerson motors for refrigerator service and wherever high starting torque and quietness are needed have been announced by the Emerson Electric Manufacturing Company, St. Louis, Mo. The stator or field has a main and auxiliary or phase winding with condenser in series. Starting is accomplished by the capacitor principle, but with the Emerson design; only line voltage is required on the condenser or motor winding in the circuit; no high voltages are required to obtain the high starting torque.

After speed is attained, the cutout opens the phase winding, the condenser is cut out of circuit and the motor operates on the main winding as a standard induction type. A patented single-circuit cutout of "snap break" contact type is employed.

▼

UNIT HEATERS said to circulate a large volume of thoroughly heated air and known as the "Chromalox Heetflo" heaters are announced by Edwin L. Wiegand Company, Pittsburgh, Pa. The heaters are equipped with thermal cutouts that will automatically open the heating circuit in case the blower does not operate.

•

AN AUTOMATIC MACHINE for welding metal beer barrels by the shielded arc process is announced by the Lincoln Electric Company, Cleveland, Ohio. It is equipped with a Lincoln "Electronic Tornado" automatic welding head, will produce barrels of different types of construction to meet the manufacturer's requirements and may be supplied with single or double automatic stationary welding heads.

▼

Bearing Thermostats for Protection from Breakdowns

For protecting motor-driven and other types of rotating machinery from breakdowns due to overheated bearings, the Electric Controller & Manufacturing Company, Cleveland, Ohio, has announced the EC&M bearing thermostat. It is of simple but sturdy construction and is very compact. It consists of a sealed metallic bulb, containing a volatile liquid which is connected, directly or through flexible copper tubing, to a one-piece seamless metal bellows. The electrical contacts are silver and are of double break, quick make and quick break construction. A rise in temperature of the bearing of a rotating machine causes the volatile liquid to expand and generate pressure in the bulb. This pressure, in turn, is transmitted to the bellows, causing the contacts to open and shut down the machine.

▼

PARKER-SAFETY FUSE PLUG, produced by the Union Insulating Company, New York, offers a number of advantages in fuse plug construction. It is made of molded bakelite, which provides complete insulation with great mechanical strength, and is non-shatterable under extremely heavy short circuits. It is equipped with a silver fuse wire which is said to be more accurate than zinc.

•

VOLTAGE REGULATORS in three standard ratings 60, 120 and 250 watts for 90-130 volt line potential and an output voltage of 115 ± 1 per cent are offered for single-phase 60 cycle service by the Delta Manufacturing Company, Cambridge, Mass. Notably satisfactory efficiency and power factor are said to be characteristic of this line which involves essentially two transformers with the primaries in series. One transformer operates at high magnetic density and the other at moderate magnetic density. The secondaries of the transformer are connected in series opposed. Other regulators are available in special designs up to 5 kva.